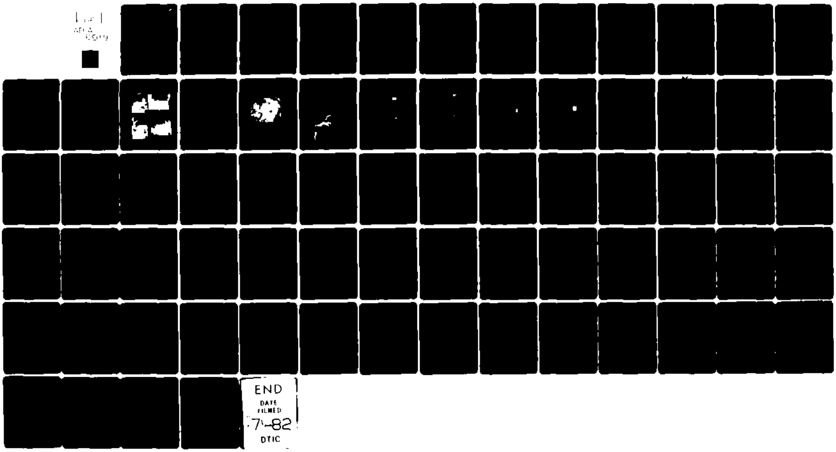
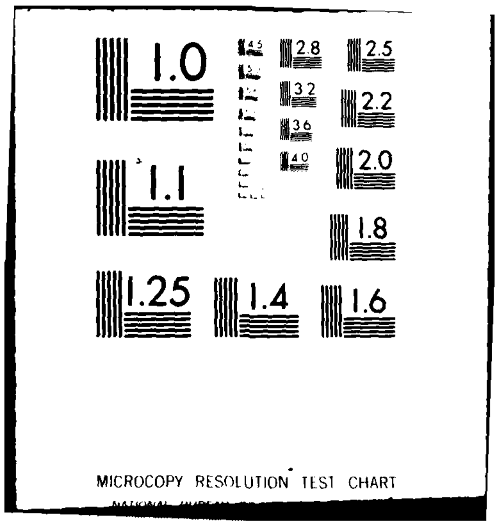
AD-A116 019 FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTE--ETC F/G 4/1
DETERMINATION OF CLOUD ALBEDO FOR CERTAIN CLOUD CONDITIONS IN T--ETC(U)
MAR 82 R REITER, R SLADKOVIC DAERO-77-G-042

UNCLASSIFIED NL




1.0
4.5
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6
MICROCOPY RESOLUTION TEST CHART

(8)

AD__________

DETERMINATION OF CLOUD ALBEDO FOR CERTAIN CLOUD CONDITIONS IN THE LOWER TROPOSPHERE

Final Technical Report

by

Reinhold Reiter

and

Rudolf Sladkovic

March 1982

EUROPEAN RESEARCH OFFICE

United States Army

London England

Grant Agreement No. DAERO-77-G-042

Fraunhofer Institut für Atmosphärische Umweltforschung

Kreuzeckbahnstrasse 19

D-8100 Garmisch-Partenkirchen

Approved for Public Release; distribution unlimited

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. Report Number	2. Govt Accession No. AD-A116 C19	3. Recipient's Catalog Number
4. Title (and Subtitle) Determination of Cloud Albedo for Certain Cloud Conditions in the Lower Troposphere (Tropospheric Cloud Albedo)		5. Type of Report & Period Covered Final Technical Report May 1977 - April 1980
		6. Performing Org. Report Number
7. Author(s) Reinhold Reiter and Rudolf Sladkovic		8. Contract or Grant Number DAERO-77-G-042
9. Performing Organization Name and Address Institute for Atmospheric Environmental Research Director: Dr. R. Reiter D-8100 Garmisch-Partenkirchen, W-Germany		10. Program Element, Project, Task Area & Work Unit Numbers R & D 2445
11. Controlling Office Name and Address USARDSG-UK Box 65, FPI New York, NY 09510		12. Report Date March 1982
		13. Number of Pages 11+ Figs.A-I and 1 - 48
14. Monitoring Agency Name and Address		15. Unclassified
16. & 17. Distribution Statement Approved for public release; distribution unlimited.		
18. Supplementary Notes		
19. Key Words Albedo of clouds and ground, recordings with cable car, pyranometers upward and downward on cable car, runs between 1 and 3 km a.s.l.		

20. Abstract

Only rare measurements are so far available of cloud albedo under varying cloud conditions. Data of such type, however, are urgently wanted for a better estimate of observations by spaceborne operators and sensors. An instrumented cable car overcomes a height difference of approx. 2 km (photograph). The cable car is frequently under, in, or above clouds of most varied horizontal and vertical extension and different structure in the upper and lower sections. Therefore in a horizontal plane of incidence the visible part of radiation incoming from above and below was recorded by pyranometers during the cable car runs. These runs were executed under cloud conditions being such that applicable results are to be expected in terms of the topic.

Data are presented in graphs, giving finally the value of cloud albedo as a function of altitude and cloud type.

FORM 1473

Table of contents

1. Abstract

Only rare measurements are available so far of cloud albedo under varying cloud conditions. Data of such type, however, are urgently needed for a better assessment of observations by spaceborne operators and sensors. An instrumented cable car traverses a height difference of approximately 2 km (photograph). The cable car is frequently under, in, or above clouds of most varied horizontal and vertical extension and different structure in the upper and lower sections. Therefore, in a horizontal plane of incidence the visible part of radiation incoming from above and from below has been recorded by means of pyranometers during the cable car runs. These measuring runs have been executed under cloud conditions which were such that applicable results could be expected in terms of the topic. Data are presented in graphs, giving finally the value of cloud albedo as a function of altitude and cloud types.

2. Technical Details

Measurement of the global radiation required first provision of appropriate instruments. It was an obvious idea to use the pyranometer after Dirmhirn (manufacturer Schenk & Co., Wien) which for many years is successfully operated at our fixed mountain stations. The calibration constants of this instrument are known to us, recalibration equipment was available, and has very often been used.

Furthermore it was necessary to procure suitable recorders. Only battery-operated strip recorders with high input sensitivity, multiple variability of sensitivity, and paper feed came into question.

After receipt of the instruments, adequate devices have been constructed to attach the instruments reasonably to the cable

car, independent of air temperature (special integrated circuits of military type).

We designed an electronic circuitry to ensure that the recorders operated only while the cable car was in motion and not during the stops at the stations.

An additional circuitry was developed which plots before the start of recordings a time mark on the recording sheet. This time mark indicated the time at which recording was effected. Figures A, B, C, and D show the instruments mounted on the cable car.

The response time of the Dirmhirn pyranometer has been measured: 85% of the final value are reached after 10 seconds; 100% of the final value practically after 20 seconds.
On the average, the cable car traverses a *height* difference of 3.3 m per second, meaning that the pyranometer is operating at an inertia of about 30-40 m height difference in each case.

Continuous recordings of the global radiation are taken by Dirmhirn pyranometers at the stations Zugspitze, Wank, and Garmisch-Partenkirchen, differentiating thereby between total radiation and sky radiation. In addition, at these three stations, sunshine duration is recorded, and at the stations Wank and Garmisch-Partenkirchen visibility and aerosol particle spectrum.

Fig. A shows the tram after leaving the valley station:

P_1 = attachment point of the upward directed pyranometer,

P_2 = attachment point of the downward exposed pyranometer.

Fig. B shows the bottom of the tram with pyranometer P_2.

Fig. C shows behind pyranometer P_2 the point (r) where the box with the two recorders is inserted (arrow).

Fig. D shows the upward looking and always vertically oriented pyranometer. It can clearly be seen that it overtops all components of the cable car construction and cables.

3. Topographical Conditions

The figures below may illustrate the terrain traversed by the cable car and the profile of its path.

Fig. E gives a scale cross section through the path of the tram and shows the soil structure below the path.

Fig. F provides for the sake of clarity an air photograph (taken before construction of the cable car which was added later). This picture gives a good idea of soil conditions along the path of the tram. The lowest part, not visible on the picture, leads to the valley station and covers a dense spruce forest only.

Fig. G is a section of an official map of the Topographical Office Munich from 1972. This map provides additional information on the soil structure. The path of the Zugspitze cable car and the two towers can be seen. The green area means dense forest (spruces). Only small alpine pines grow in rubble within the area indicated as "Riffel". With increasing height there are pure rubble and finally rocks up to the summit.

4. Some First Results Intended as Examples, Including Temperature and Electric Air Conductivity Profiles

Figures H and I show as example how useful measurements of the profile of global radiation on the Zugspitze cable car are graphically plotted. The figures contain - as a function of height - the outgoing radiation (R↑) and the incoming radiation (R↓). In the left are plotted temperature T and electrical conductivity λ_+. The global radiation is indicated in absolute units (see scale in the figures). Meteorological observations and cloud situations are entered at the right side of the plot.

The plots of the global radiation as shown in the figures, are obtained in the following way:

The original recordings, acquired aboard the cable car, are digitized by a computerized digitizer considering the time elapsed since departure. Still during the digitalization process the following actions take place: Automatic plotting, output of data on punch tape, outprint of data on a table in absolute units as a function of height.

Figures H and I give examples of such plots including all other desired parameters. In the case of Fig.H,a and H,b (one hour later) a dense stratus cloud with varying thickness and cloud top extended between 1100 and some 1500 m. The same day, practically dense altocumulus was present at an altitude of little more than 3000 m. The top of the stratus cloud is clearly identified by the electrical conductivity of the air.

In the case of Fig.I,a and I,b (one hour later) a stratus cloud was present between 1400 and about 1900 m with rather constant cloud base and top which are clearly discernible through the recorded conductivity λ_+. Over the stratus cloud,

up to a height of 2400 m, a sharp dust layer existed with well defined upper boundary. Again, the upper boundary of dust can fairly well be identified through the electrical conductivity. The albedo-value can be derived directly from the curve pair R↑ (upward radiation) and R↓ (downward radiation).

In the systematic evaluation of recordings which follows we proceed to the most possible extent in a way giving as a final result the albedo value A.

Certainly it is not an easy task to quantitatively determine the often rapidly changing conditions of the soil structure due to snow on the ground below the cable car. The kind of snow cover varies frequently and is sometimes hard to define.

The following difficulties are to be mentioned:

a) Icing of the Dirmhirn pyranometer. In the case of supercooled clouds, ice coating occurred initially often at the window of the pyranometer making the measurements useless. We tried to avoid formation of such ice coating by applying a thin glycerine film on the window. Application of this procedure guarantied that the measurements were not severely affected by this glycerine film.

b) Partial shading of the direct sun along the path of the tram through the horizon of the mountains. The shading of one part of the cruise varies strongly with time as the profile of the mountains changes rapidly relative to the position of the sun. Most probably exposure to sunshine and shadow, respectively, will show up in the recordings. The situation is more difficult when the sky is partly overcast with clouds which, in turn, temporarily cause additional and variable shadiness. We are not yet quite sure whether recordings taken during runs under such conditions will be of use for the studies.

5. Results, Given by Plots of Radiation and Albedo Data. Results for the Period 5 December 1978 to 19 May 1979 are Presented in the SECOND ANNUAL REPORT

5.1. Recent Results From June 1979 - January 1980, Some Remarks on the Computer Plots

The entire data have been plotted as profiles versus height. Thus, the user may critically survey and assess the situation.

In Figures 1 - 25 are plotted the recorded radiation intensities in cal x cm^{-2} x min^{-1} as height profiles:

The solid line (———) means radiation from above,
the dashed line (------) means radiation from below.

Figures 26 - 48 are plots of the calculated albedo height profiles.

5.2. Meteorological Description of the Measurement Days

12.06.1979, Figs. 1 - 3; 26 - 28

At first cloudless. In the course of forenoon rapid increase of convective clouding. On the one hand, the tram is temporarily in the shade of this convective clouding during its cruise; on the other hand - probably through reflection of solar radiation from the sunlit cloud tops on the upward directed star pyranometer - very high radiation values are recorded by the pyranometer. These reflection effects (from cloud and snow cover) lead also on the other measurement days to the short-time-recorded very high values of the global radiation.
The measuring path was cloudless all the time.

08.30 CET	1/10 Cu-hum	3000 m ASL, 1/10 Ci
12.45 CET	3/10 Cu-med	3000 m ASL, 1/10 Ci
17.00 CET	5/10 Cu-med, Cu-con	2500 m ASL

No special thermal or aerosol stratification present.

<u>18.07.1979, Figs. 4 - 8; 29 - 33</u>

Fair weather with just slightly developed Cu-clouds.

08.30 CET	1/10 Cu-fra	2500 m ASL, 1/10 Ac
12.30 CET	2/10 Cu-hum	3000 m ASL
16.45 CET	1/10 Cu-hum	3000 m ASL

The measuring path was cloudless all the time.
No particular thermal or aerosol layers existed.

<u>25.07.1979, Figs. 9 - 13; 34 - 38</u>

Fair weather, just little Cu-cloud development.

07.30 CET	almost cloudless	
12.00 CET	1/10 Cu-hum	3000 m ASL
16.30 CET	2/10 Cu-hum, Cu-med, 2400-3000 m ASL	

The measuring path was cloudless all the time. In the forenoon hours, the electrical conductivity was clearly higher above 2000 m ASL than in the layer below. From noon, any special thermal or aerosol layers are no longer present.

<u>22.11.1979, Figs. 14 - 16; 39 - 40</u>

In the morning the closed stratus sheet extends to 1300 m ASL. Almost cloudless weather prevails aloft. In the course of forenoon the stratus sheet begins to disperse. By afternoon, again increase of the high fog-like cloudiness.

07.40 CET	10/10 St	900 m ASL
12.45 CET	7/10 Sc	1000 m ASL
16.30 CET	10/10 St	1000 m ASL

The measuring path is in the cloud layer up to 1200-1300 m ASL. An extremely strong temperature inversion is moreover present between 2200 and 2400 m ASL which from noon is marked by a cloud band of 100-200 m thickness.
Unfortunately a technical failure occurred in the upper pyranometer (defective paper feed).

23.11.1979, Figs. 17 - 18; 41 - 42

First, cloudless weather prevails. From noon, the stratus sheet drifts from the pre-alpine region from north to the Garmisch-Partenkirchen basin. At about 15.00 h, also the Eibsee is reached by this cloud layer. The top of the cloud layer is then situated at about 1300 m ASL. Above it, there is still a very hazy, but still sunlit layer, and higher up everything is in the shade (observed from Wank peak).

07.45 CET	almost cloudless	
12.45 CET	almost cloudless	
14.00 CET	10/10 St	1100 m ASL
16.30 CET	10/10 St	1100 m ASL with top at about 1400 m ASL

The measuring path is first cloudless. At 14.30 h, the very hazy air - and a little later also the stratus sheet - reach our measuring path which is then in clouds between 1150 and 1400 m ASL. From noon, a strong temperature inversion is present between 1400 and 1500 m ASL.

Remark: Today's troublefree recording of the *upper pyranometer* could almost probably *be used also for the measuring run of 22.11.1979* (technical fault).

28.11.1979, Fig. 19; 43

Weather conditions were most favorable this day. The strong subsidence from above continues to lower levels. Therefore, the air layer above 1400-1500 m ASL is very dry and visibility conditions very good. Below, there is a very humid air layer. The extremely strong temperature inversion lies at about 1400 m ASL.

12.00 CET	10/10 stratus	950 m ASL
16.20 CET	10/10 stratus	950 m ASL

The measuring path is in clouds up to 1400 m ASL and cloudless above that level. Albedo-measurement could unfortunately be started only at noon due to a technical failure in the relay transmitter.

09.01.1980, Figs. 20 - 21; 44 - 45

Wonderful winter weather. At first almost cloudless. By afternoon, rapid increase of Ac-clouding.

07.45 CET	practically cloudfree	
12.00 CET	almost cloudless	
16.30 CET	6/10 Ac	3000 m ASL

The measuring path is cloudless all the time. The high radiation values at the upper star pyranometer are due to reflection from snow fields.

11.01.1980, Figs. 22 - 23; 44 - 45

This day, the weather conditions were ideal for cloud albedo measurement. A rather thick cloud layer (from which fell even light snow) reached up to about 2000 m ASL and above it the sky was cloudless.

07.45 CET	10/10 stratus	900 m ASL
12.00 CET	10/10 stratus	1000 m ASL
16.15 CET	8/10 Sc	1500 m ASL

The measuring path is in clouds up to 1800-2000 m ASL. Unfortunately, the paper feed at the upper pyranometer did not function troublefree. For this missing measurement one could perhaps *use the radiation values from 09.01.1980.* From the comparision of the measuring runs on 9 January and 11 January 1980 one could infer the reflection difference of snow and cloud cover, respectively.

17.01.1980, Figs. 24 - 25; 47 - 48

At first the stratus sheet reaches up to 1200 m ASL. About noon, the measuring path is temporarily cloudfree (11.40 - 12.45 CET) but still in the shadow. Later (from 13.10 CET) the measuring path is again in clouds up to 1200-1300 m ASL.

07.45 CET	10/10 stratus	1000 m ASL
12.00 CET	5/10 Sc	1300 m ASL
16.30 CET	10/10 stratus	900 m ASL

The moderate to strong temperature inversion lowers in the course of the day from 1400-1200 m ASL.

According to observations from the Zugspitze peak, the cable car was in the afternoon hours above the cloud layer only for a short time in sunshine and thereafter in shadow all the time.

Garmisch-Partenkirchen, March 15, 1982

(Dr. R. Reiter)
Director
Principal Investigator

FIGURES A - I

P1
P2
A
P2
B
P2
C
P1
D

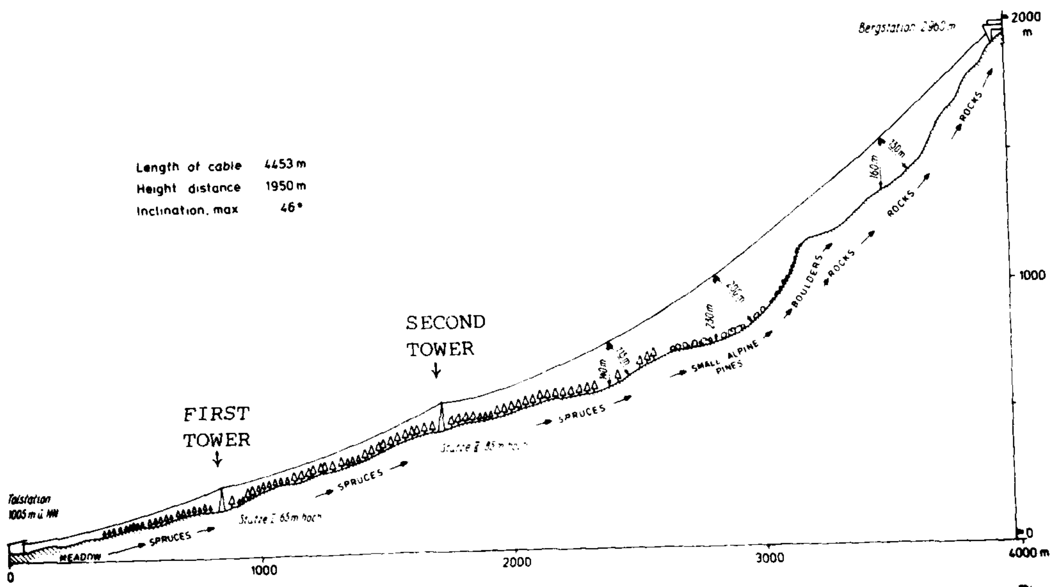

Bergstation 2960 m
2000
m
Length of cable 4453 m
Height distance 1950 m
Inclination, max 46°
SECOND
TOWER
FIRST
TOWER
Talstation
1005 m ü. NN
MEADOW
SPRUCES
SPRUCES
SPRUCES
Stütze I 65m hoch
Stütze II 65m hoch
SMALL ALPINE
PINES
BOULDERS
ROCKS
ROCKS
ROCKS
1000
0
0
1000
2000
3000
4000 m

Fig. E

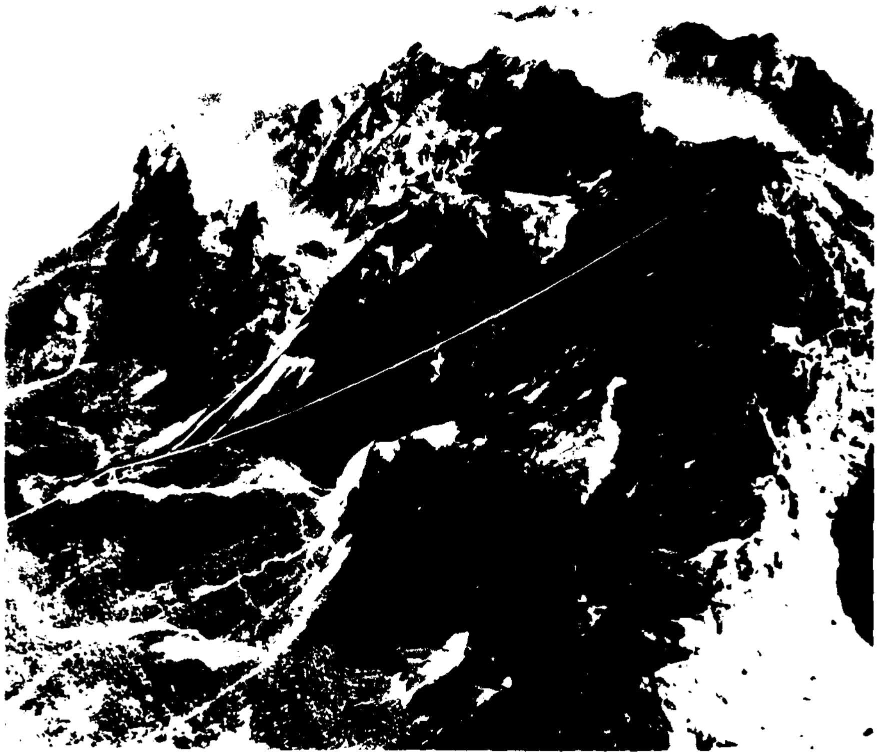
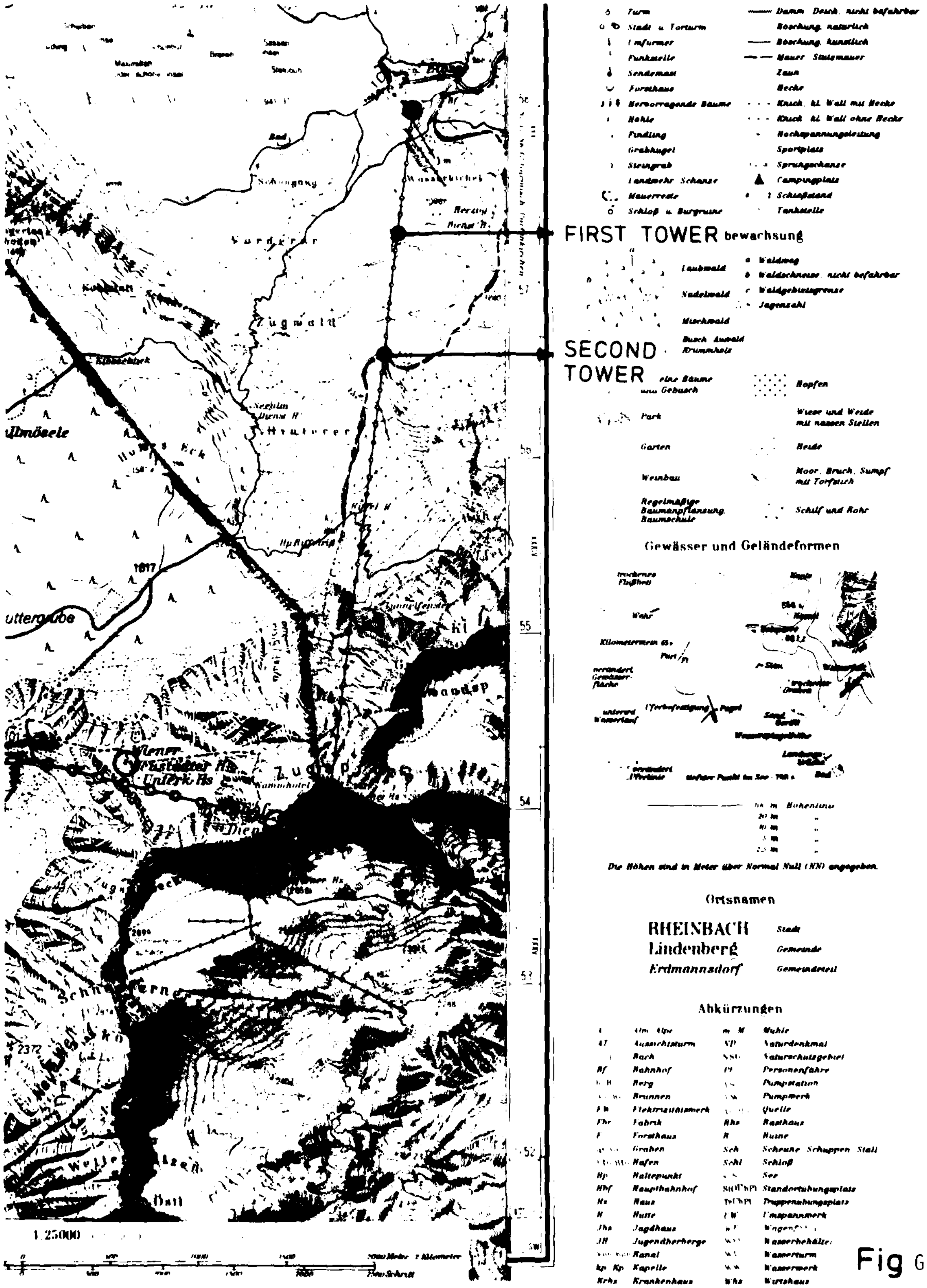


Fig. F



FIRST TOWER
SECOND TOWER
Zugwald
Vorderer
Wasserkirchel
Schongang
Zugspitze
Wiener-Neustädter Hs.
Unterk. Hs.
Schneeferner
utteragrube
1817
2372
55
54
53
52
56
57
1:25000
Turm
Stadt u. Torturm
Umformer
Funkstelle
Sendemast
Forsthaus
Hervorragende Bäume
Höhle
Findling
Grabhügel
Steingrab
Landwehr Schanze
Mauerreste
Schloß u. Burgruine
Damm, Deich, nicht befahrbar
Böschung, natürlich
Böschung, künstlich
Mauer, Stützmauer
Zaun
Hecke
Knick, kl. Wall mit Hecke
Knick, kl. Wall ohne Hecke
Hochspannungsleitung
Sportplatz
Sprungschanze
Campingplatz
Schießstand
Tankstelle
bewachsung
Laubwald
Nadelwald
Mischwald
Busch, Auwald, Krummholz
Waldweg
Waldschneise, nicht befahrbar
Waldgebietsgrenze
Jagenzahl
Hopfen
Park
Wiese und Weide mit nassen Stellen
Garten
Heide
Weinbau
Moor, Bruch, Sumpf mit Torfstich
Regelmäßige Baumanpflanzung, Baumschule
Schilf und Rohr
Gewässer und Geländeformen
Die Höhen sind in Meter über Normal Null (NN) angegeben.
Ortsnamen
RHEINBACH Stadt
Lindenberg Gemeinde
Erdmannsdorf Gemeindeteil
Abkürzungen
Alm, Alpe
Aussichtsturm
Bach
Bahnhof
Berg
Brunnen
Elektrizitätswerk
Fabrik
Forsthaus
Graben
Hafen
Haltepunkt
Hauptbahnhof
Haus
Hütte
Jagdhaus
Jugendherberge
Kanal
Kapelle
Krankenhaus
Mühle
Naturdenkmal
Naturschutzgebiet
Personenfähre
Pumpstation
Pumpwerk
Quelle
Rasthaus
Ruine
Scheune, Schuppen, Stall
Schloß
See
Standortübungsplatz
Truppenübungsplatz
Umspannwerk
Wasserbehälter
Wasserturm
Wasserwerk
Wirtshaus

Fig 6

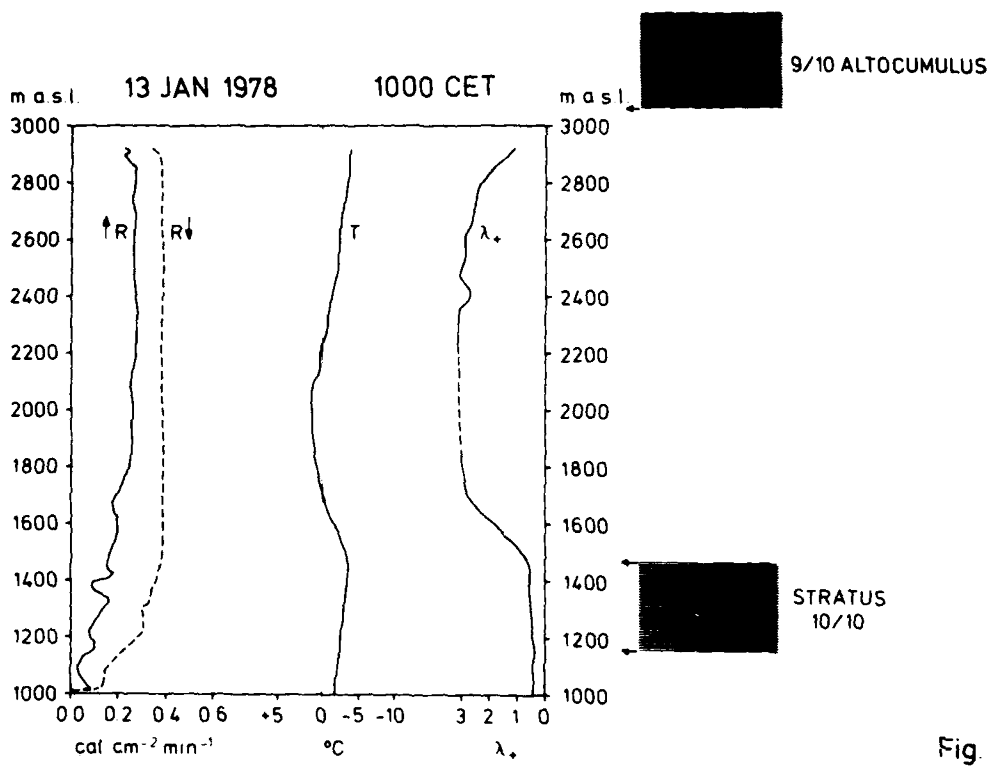

13 JAN 1978
1000 CET
m a.s.l.
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
↑R
R↓
T
λ₊
0.0 0.2 0.4 0.6
cal cm⁻² min⁻¹
+5 0 -5 -10
°C
3 2 1 0
λ₊
9/10 ALTOCUMULUS
STRATUS
10/10

Fig. H a

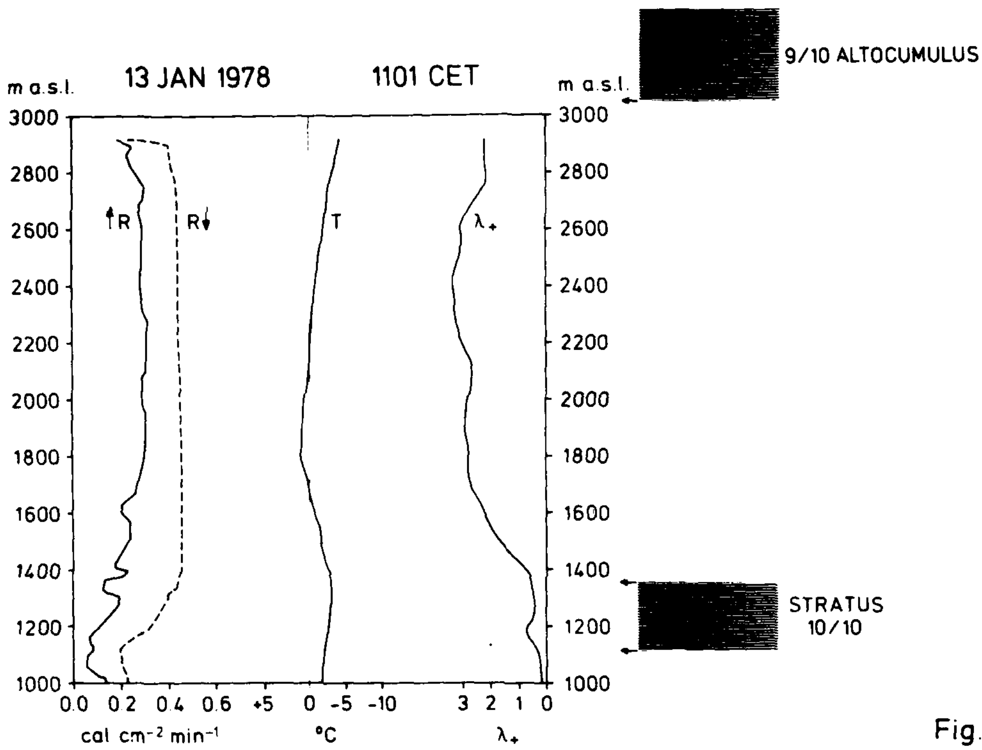
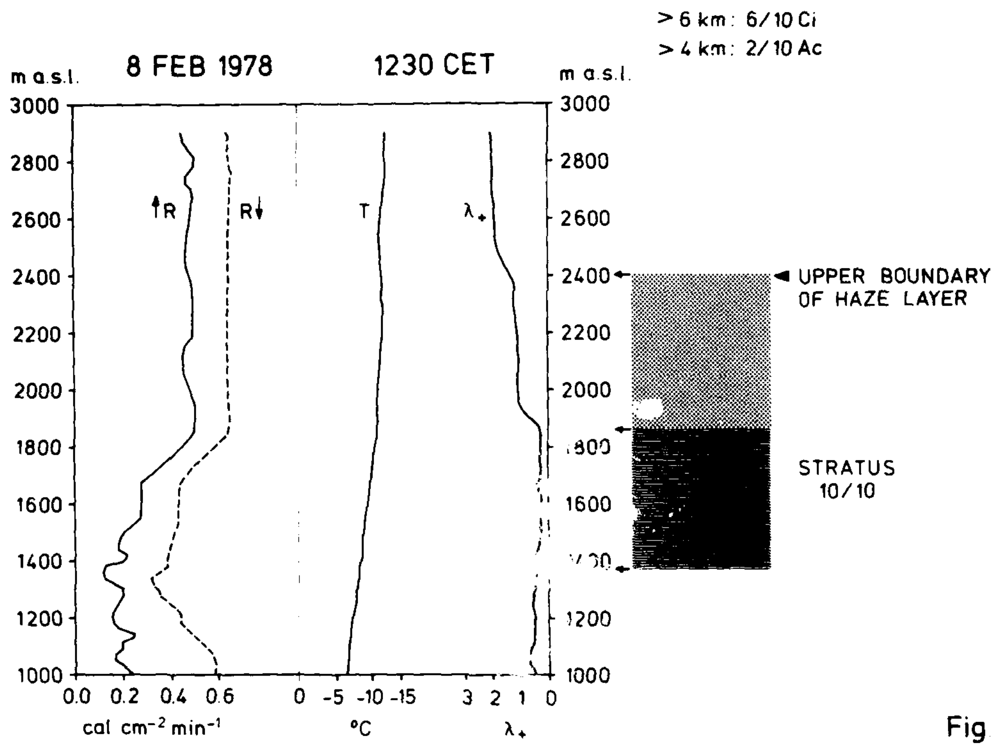

13 JAN 1978
1101 CET
m a.s.l.
m a.s.l.
9/10 ALTOCUMULUS
STRATUS 10/10
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
↑R
R↓
T
λ+
0.0 0.2 0.4 0.6 +5 0 -5 -10 3 2 1 0
cal cm⁻² min⁻¹
°C
λ+

Fig. H b



> 6 km: 6/10 Ci
> 4 km: 2/10 Ac
m a.s.l.
8 FEB 1978
1230 CET
m a.s.l.
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
↑R
R↓
T
λ+
UPPER BOUNDARY OF HAZE LAYER
STRATUS 10/10
0.0 0.2 0.4 0.6
0 -5 -10 -15
3 2 1 0
cal cm-2 min-1
°C
λ+

Fig. I a

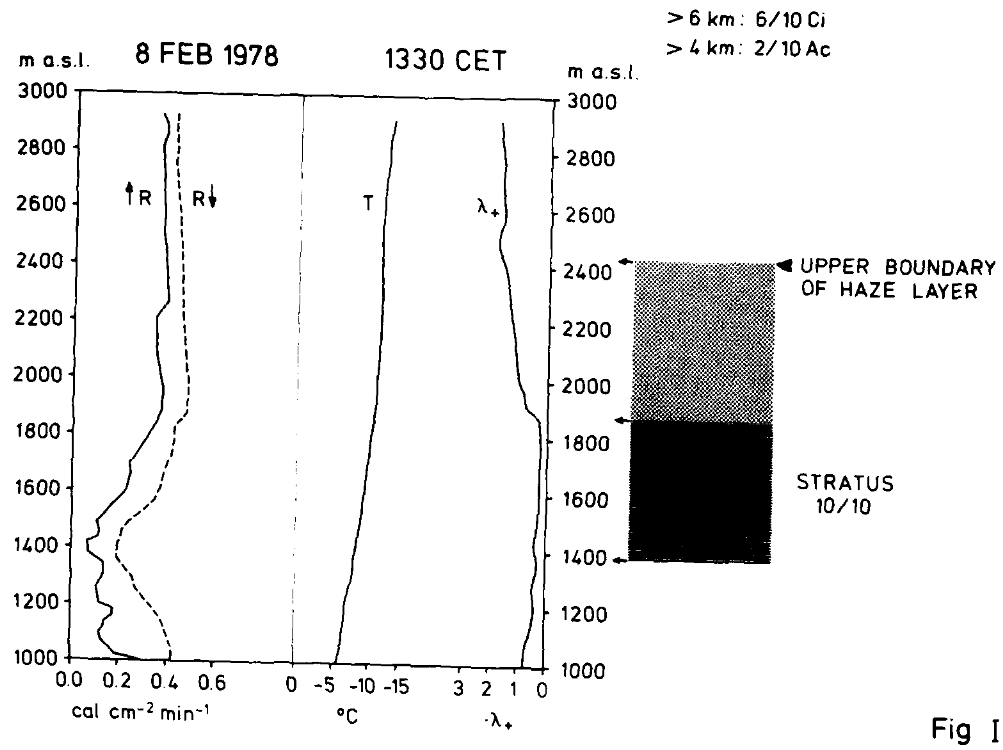

> 6 km: 6/10 Ci
> 4 km: 2/10 Ac
m a.s.l.
8 FEB 1978
1330 CET
m a.s.l.
↑R
R↓
T
λ+
UPPER BOUNDARY OF HAZE LAYER
STRATUS 10/10
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
0.0 0.2 0.4 0.6
cal cm-2 min-1
0 -5 -10 -15
°C
3 2 1 0
·λ+

Fig I b

F I G U R E S 1 - 25

Results for period June 1979 - January 1980

for previous results see

SECOND ANNUAL REPORT

Height profiles of radiation received from above
(————————) and below (--------), respectively

On top of each individual diagram date and time

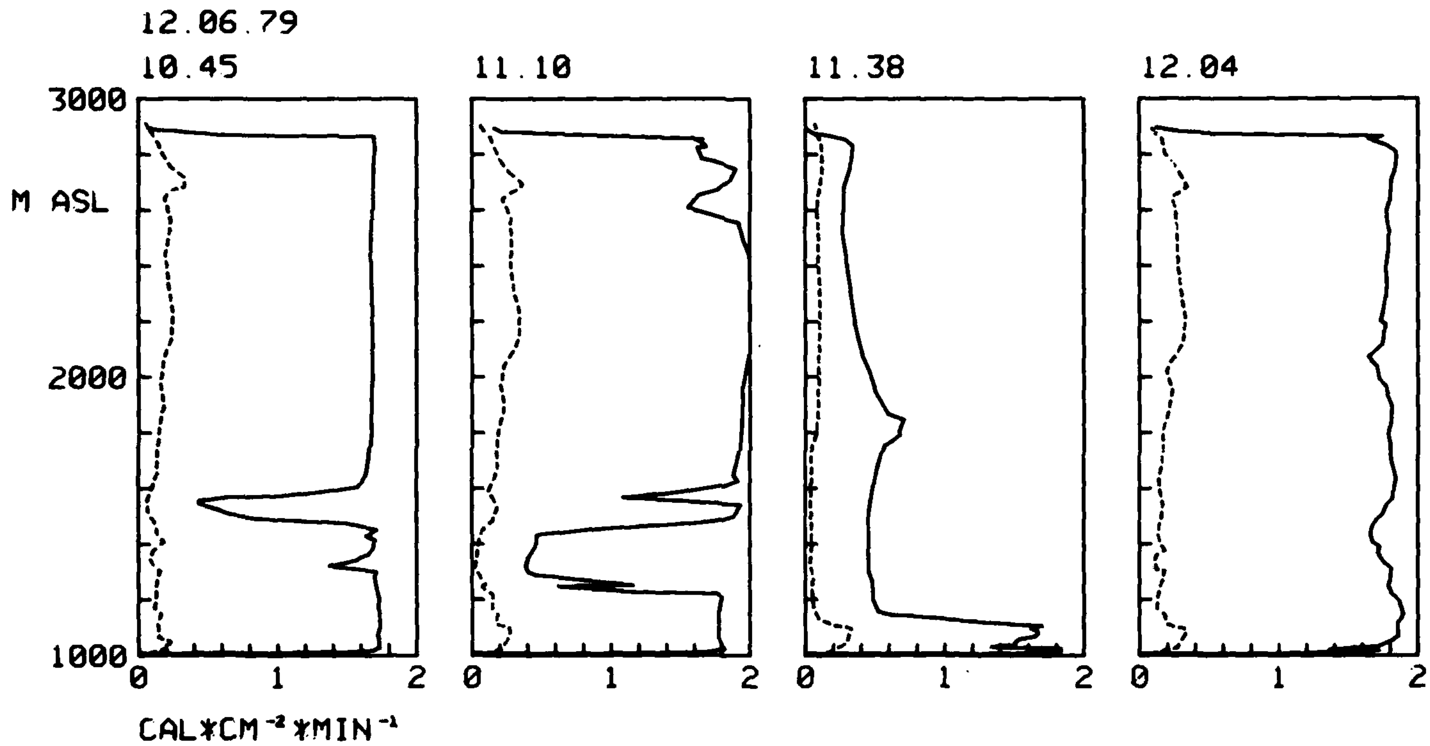

12.06.79
10.45
11.10
11.38
12.04
3000
M ASL
2000
1000
0
1
2
CAL*CM^{-2}*MIN^{-1}

FIG. 01

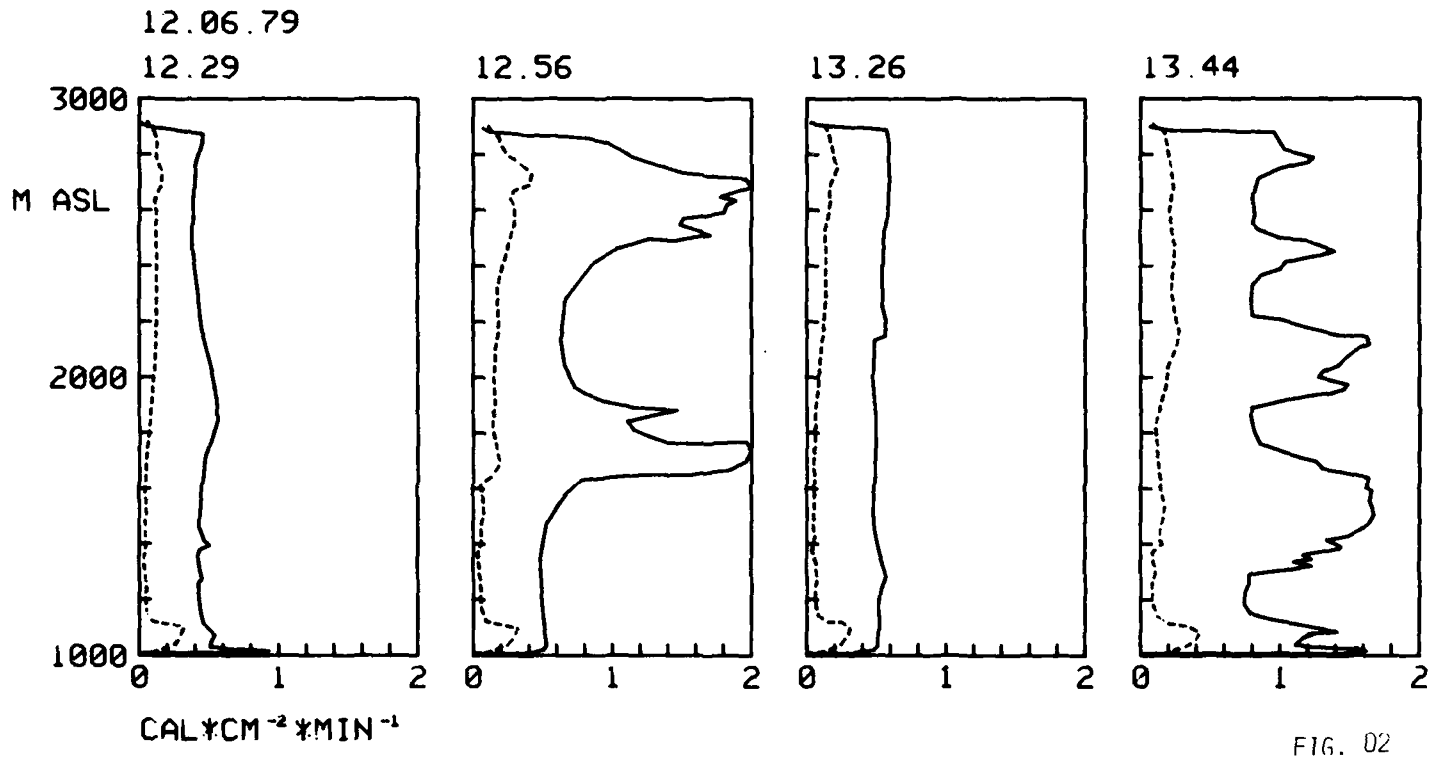

12.06.79
12.29
12.56
13.26
13.44
3000
M ASL
2000
1000
0
1
2
CAL*CM⁻²*MIN⁻¹

FIG. 02

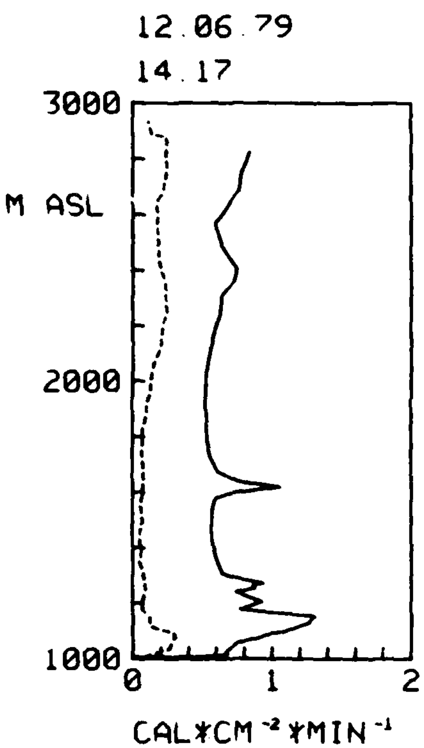


FIG. 03

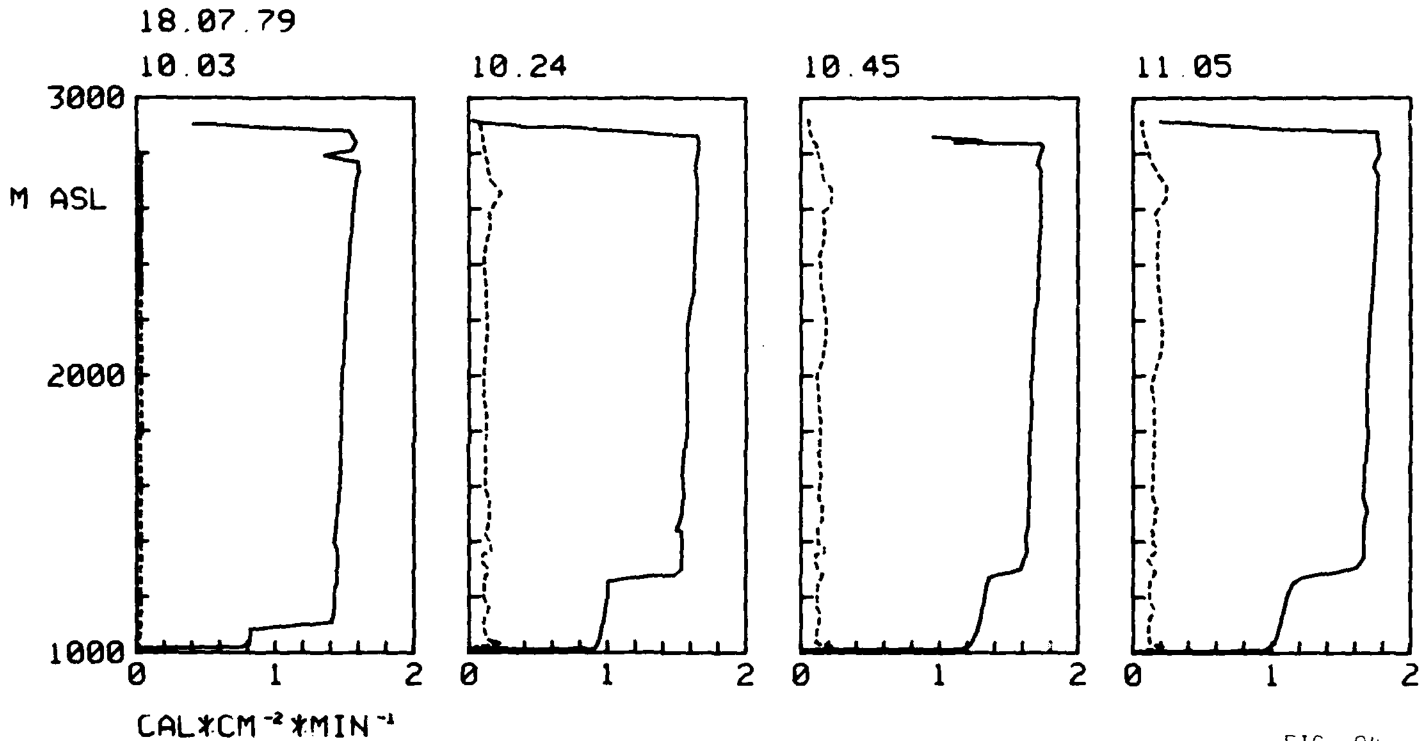

18.07.79
10.03
10.24
10.45
11.05
3000
M ASL
2000
1000
0
1
2
CAL*CM⁻²*MIN⁻¹

FIG. 04

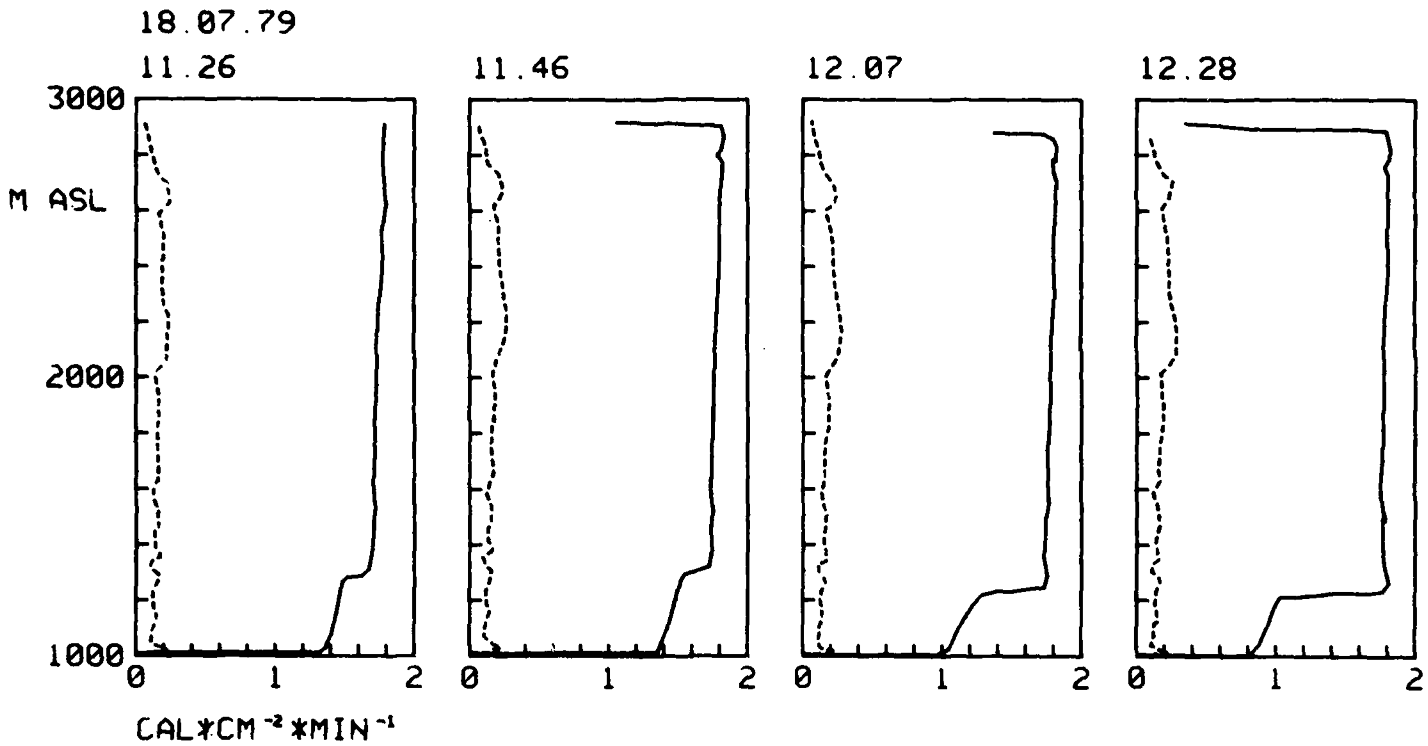

18.07.79
11.26
11.46
12.07
12.28
3000
M ASL
2000
1000
0
1
2
CAL*CM⁻²*MIN⁻¹

FIG. 05

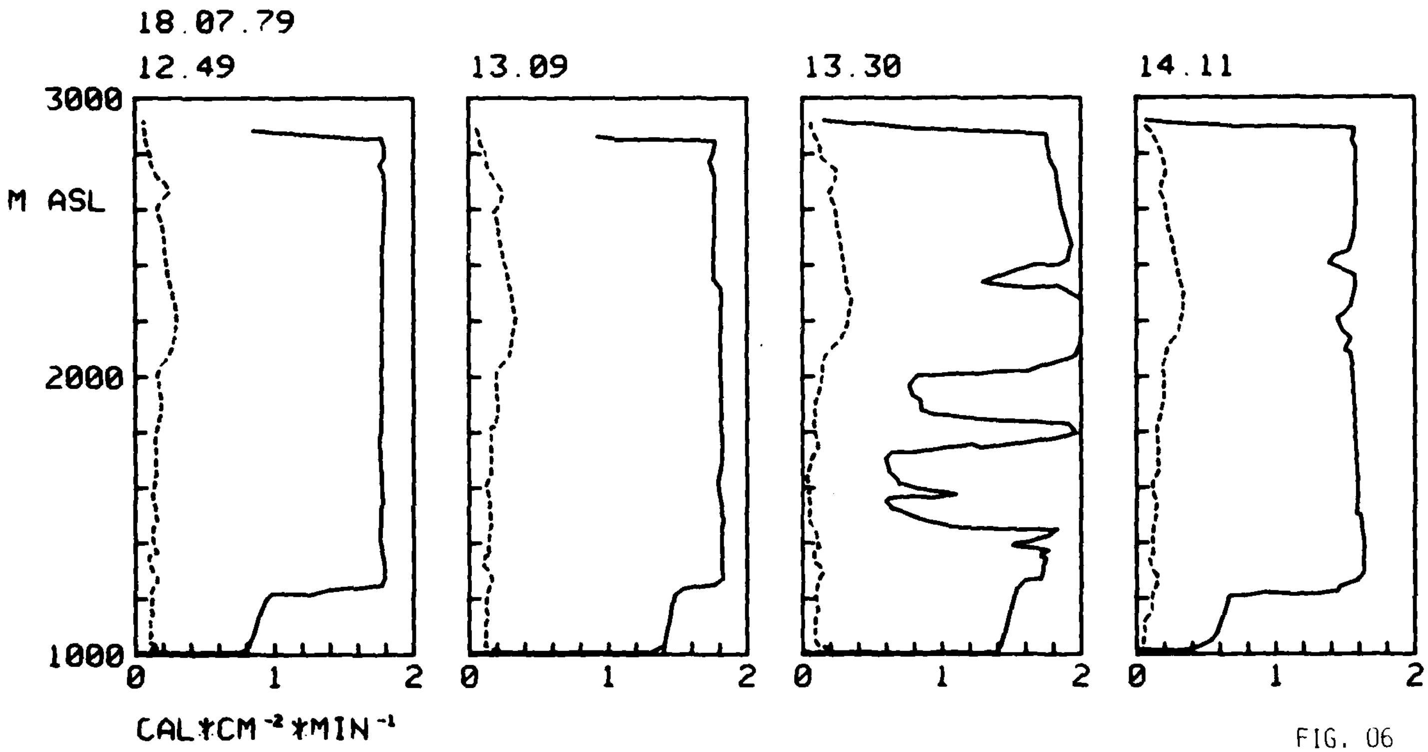

18.07.79
12.49
13.09
13.30
14.11
3000
M ASL
2000
1000
0
1
2
CAL*CM-2*MIN-1

FIG. 06

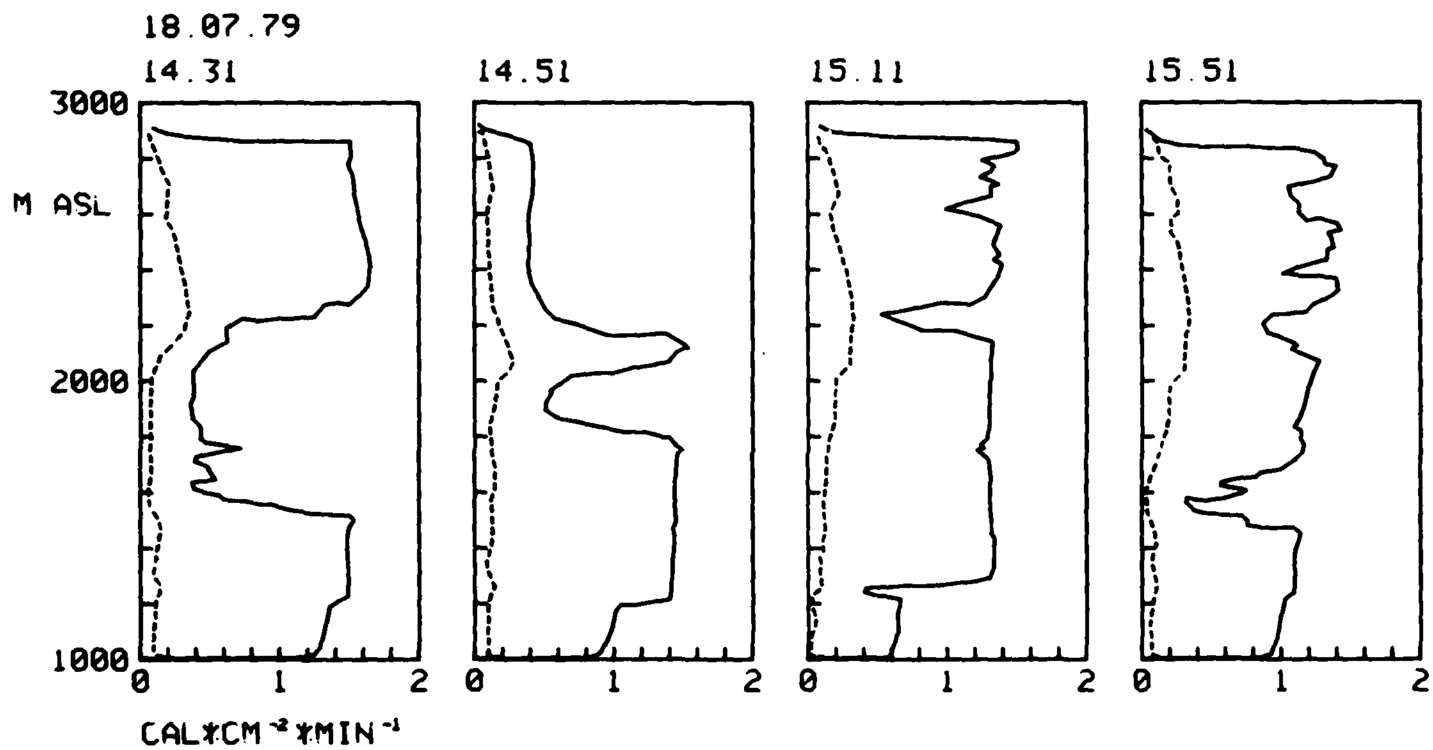

18.07.79
14.31
14.51
15.11
15.51
3000
M ASL
2000
1000
0
1
2
CAL*CM^-2*MIN^-1

FIG. 07

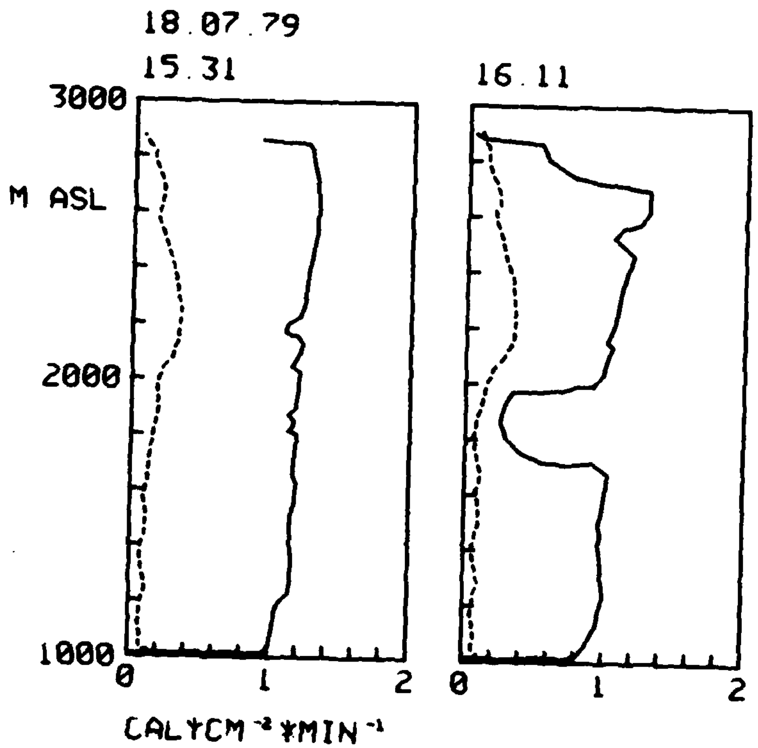


FIG. 08

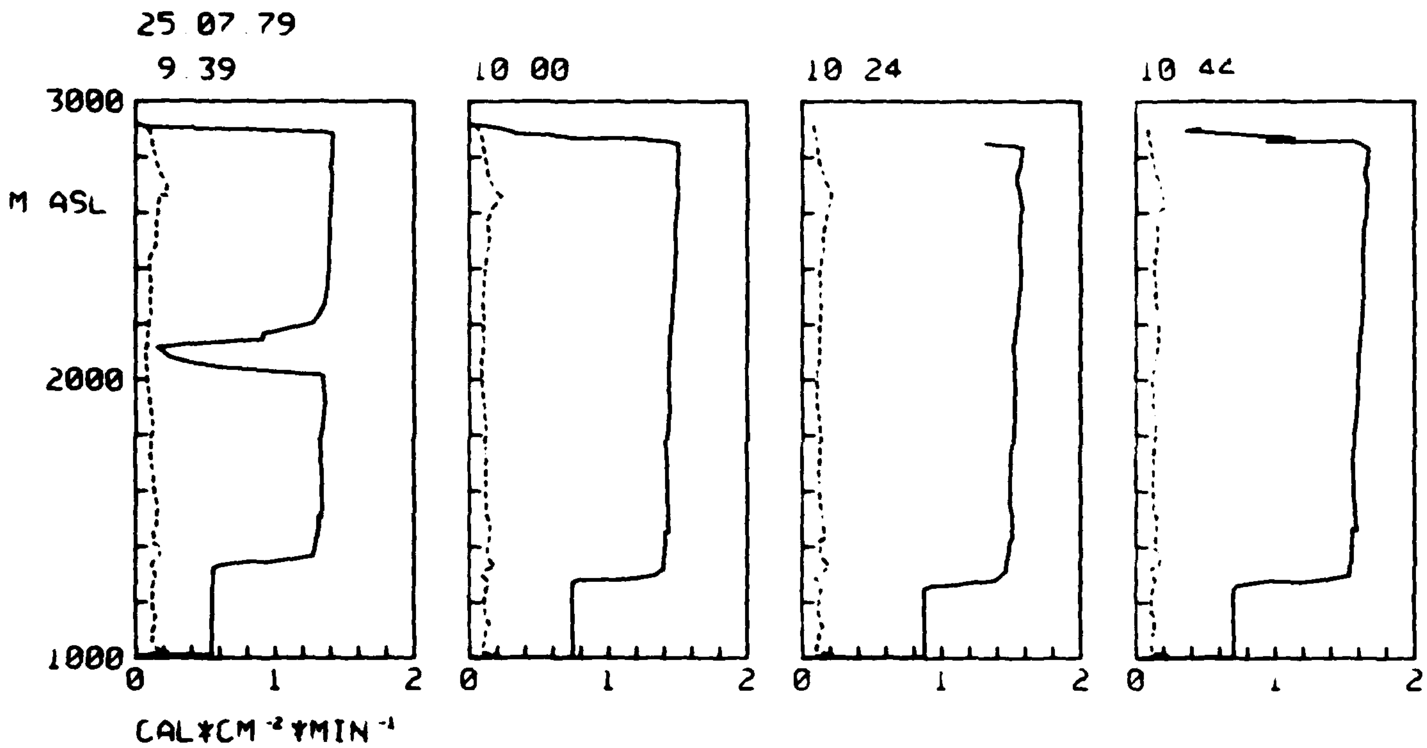

25 07 79
9 39
10 00
10 24
10 44
3000
M ASL
2000
1000
0
1
2
CAL*CM-2*MIN-1

FIG. 09

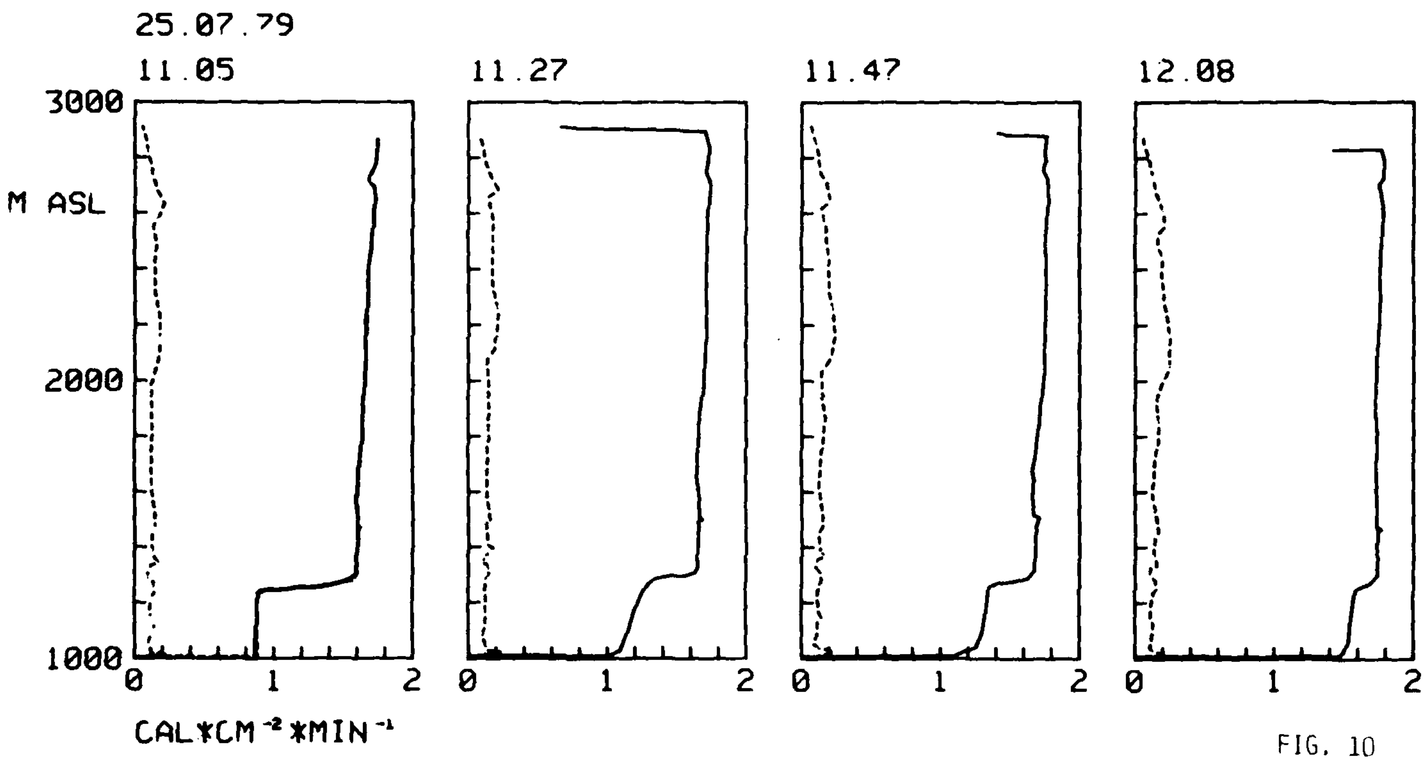

25.07.79
11.05
11.27
11.47
12.08
3000
M ASL
2000
1000
0
1
2
CAL*CM⁻²*MIN⁻¹

FIG. 10

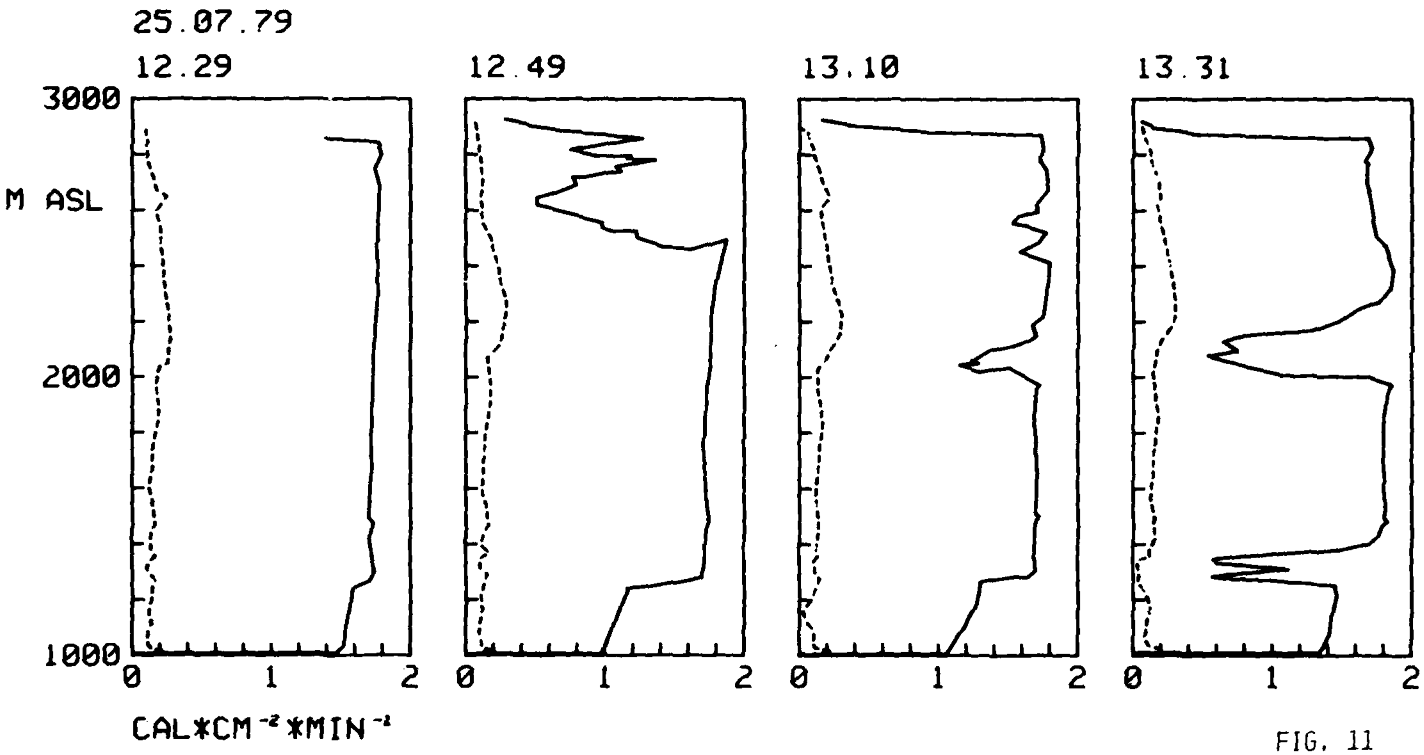

25.07.79
12.29
12.49
13.10
13.31
3000
M ASL
2000
1000
0
1
2
CAL*CM⁻²*MIN⁻¹

FIG. 11

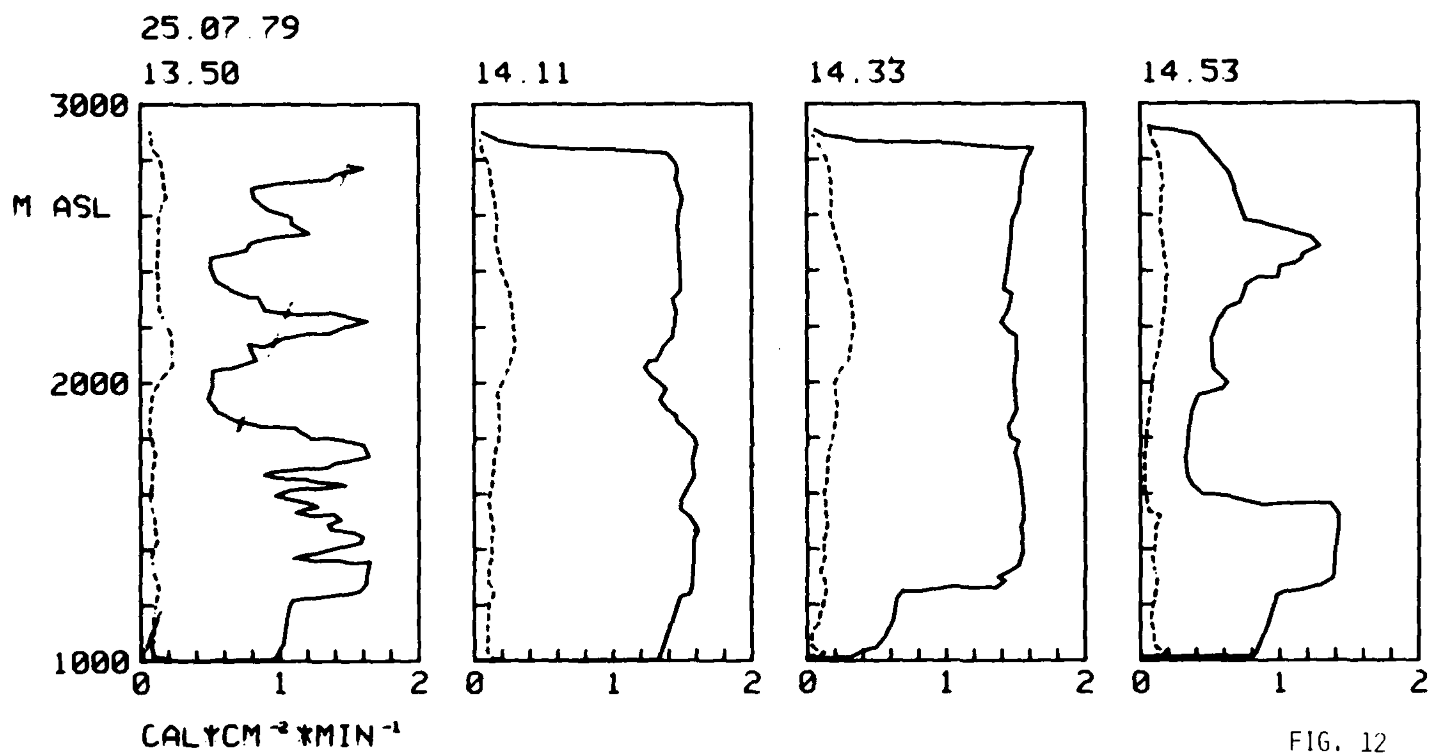

25.07.79
13.50
14.11
14.33
14.53
3000
M ASL
2000
1000
0
1
2
CAL*CM⁻²*MIN⁻¹

FIG. 12

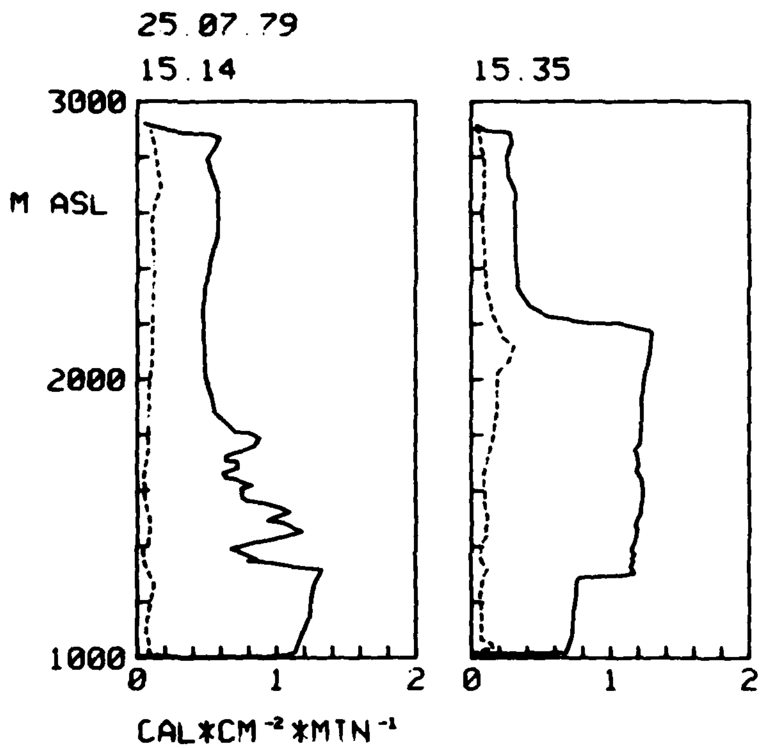
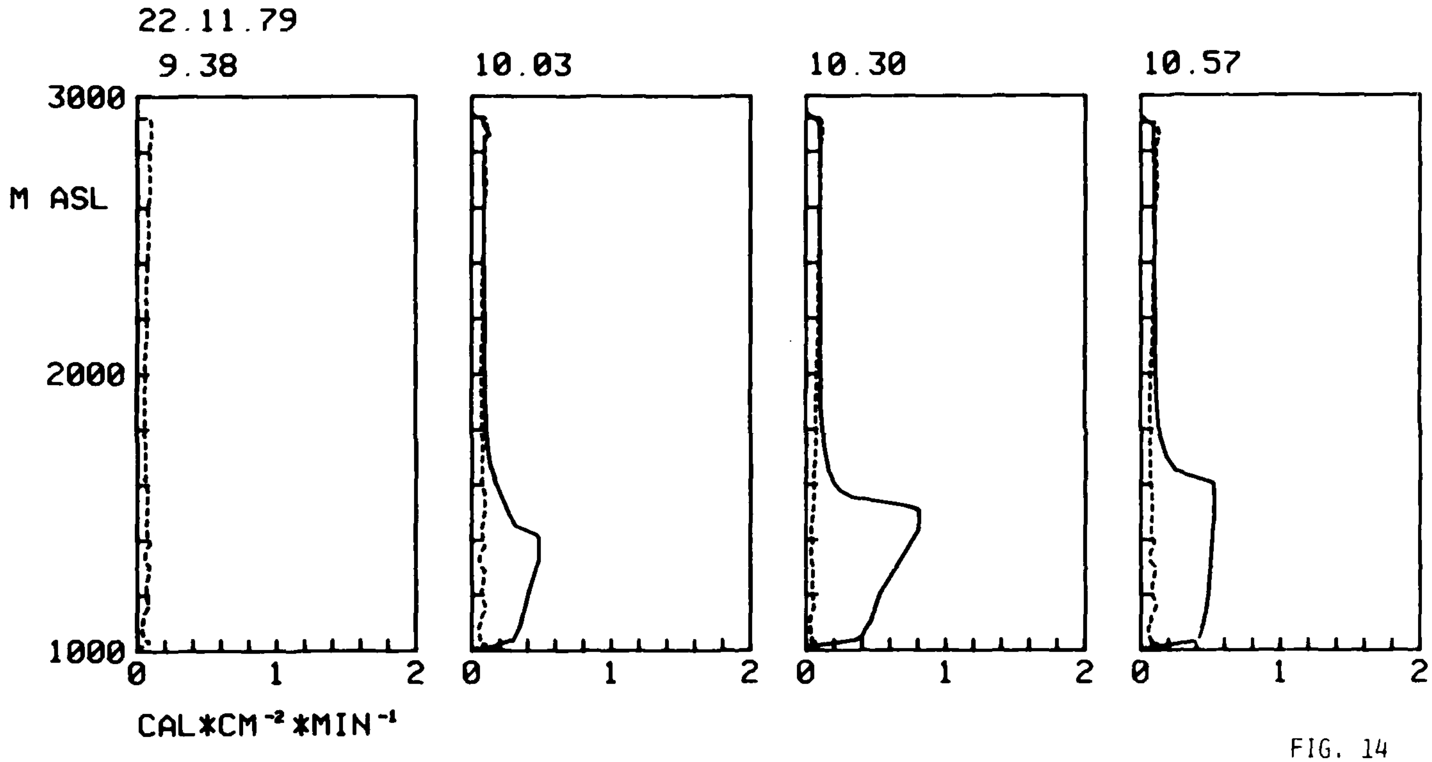


FIG. 13



22.11.79
9.38
10.03
10.30
10.57
3000
M ASL
2000
1000
0
1
2
CAL*CM⁻²*MIN⁻¹

FIG. 14

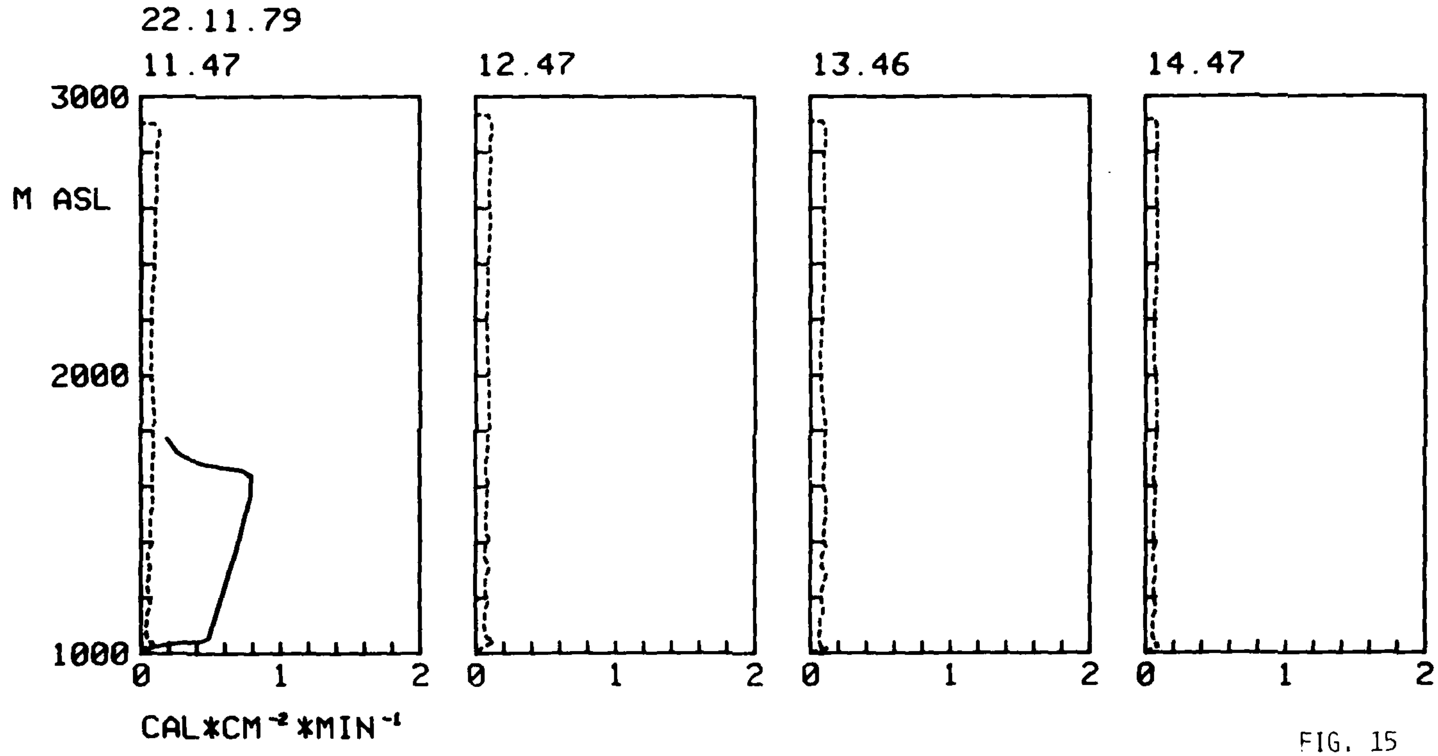

22.11.79
11.47
12.47
13.46
14.47
3000
M ASL
2000
1000
0
1
2
CAL*CM⁻²*MIN⁻¹

FIG. 15

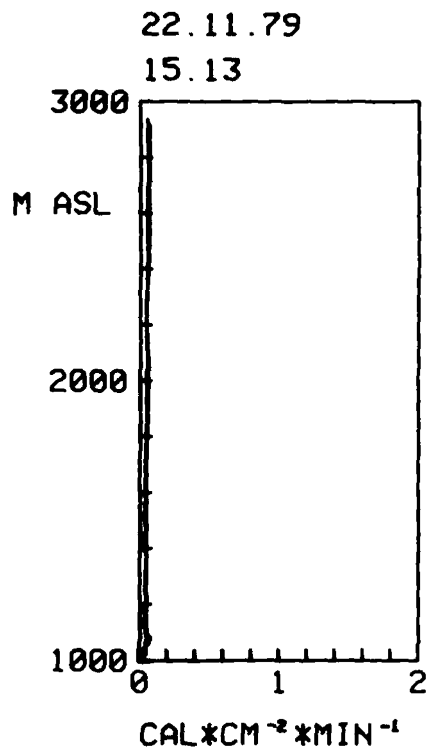
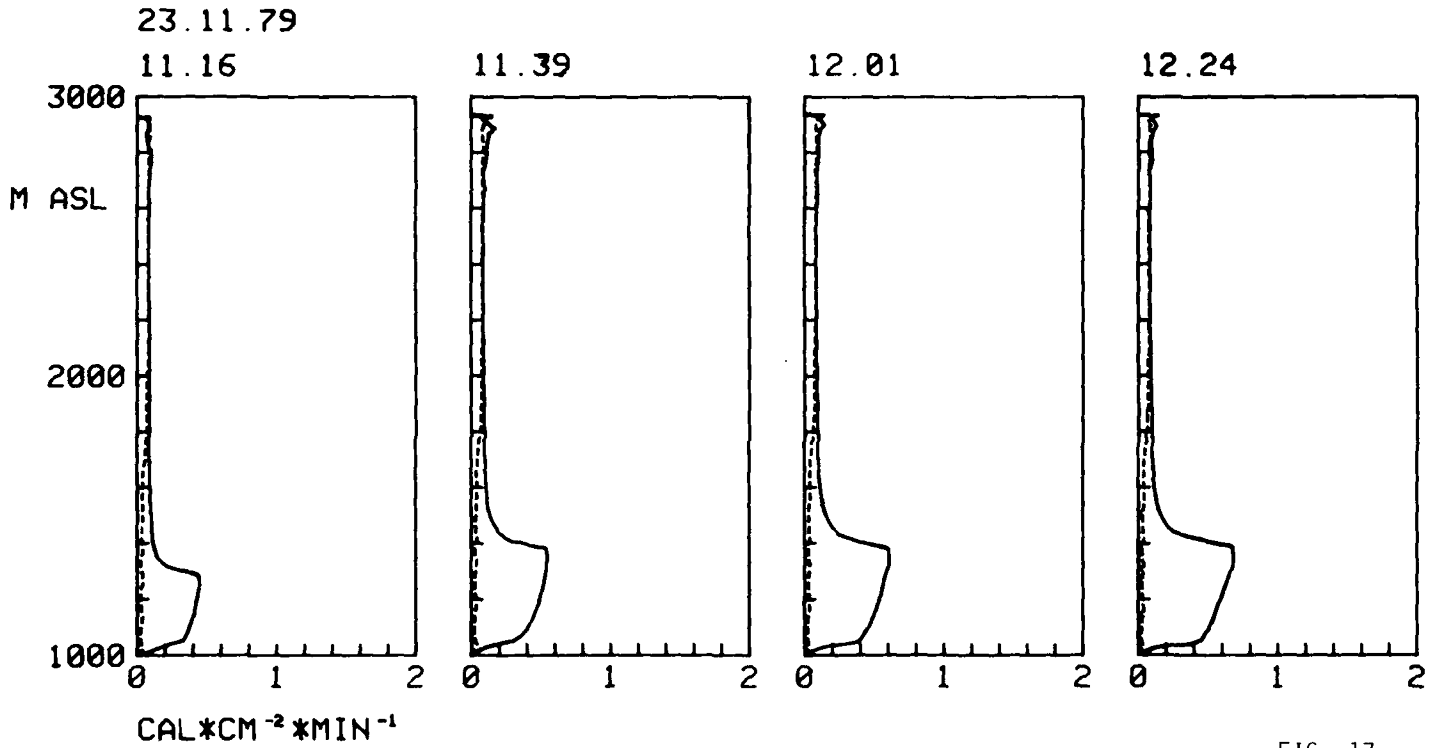
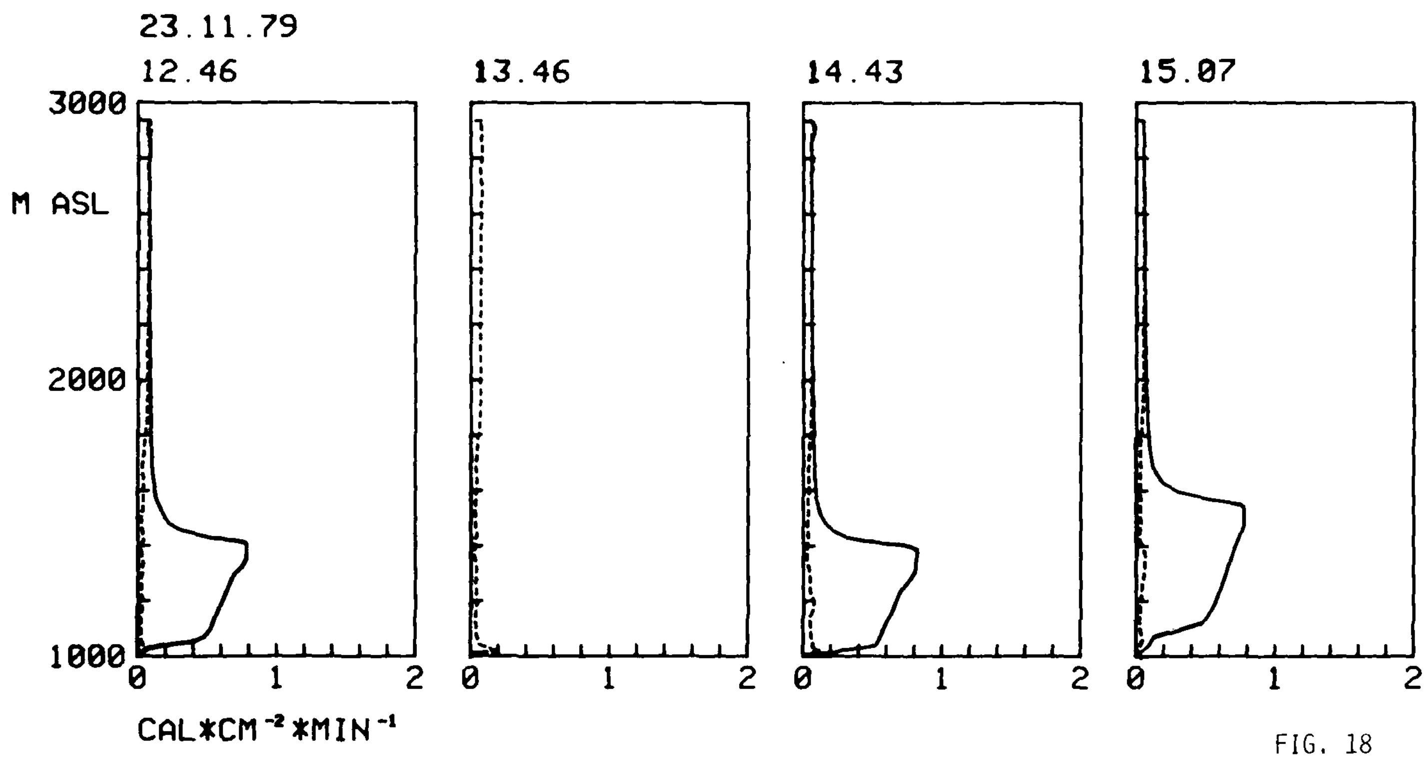


FIG. 16



23.11.79
11.16
11.39
12.01
12.24
3000
M ASL
2000
1000
0
1
2
CAL*CM⁻²*MIN⁻¹

FIG. 17



23.11.79
12.46
13.46
14.43
15.07
3000
M ASL
2000
1000
0
1
2
CAL*CM⁻²*MIN⁻¹

FIG. 18

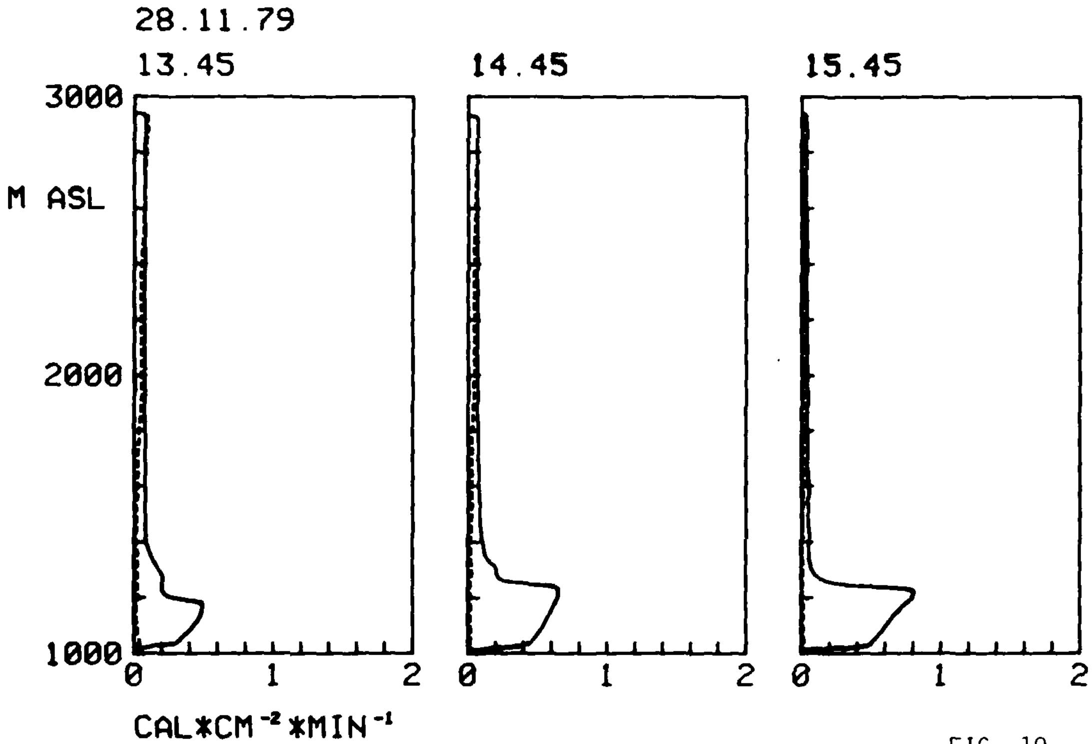


FIG. 19

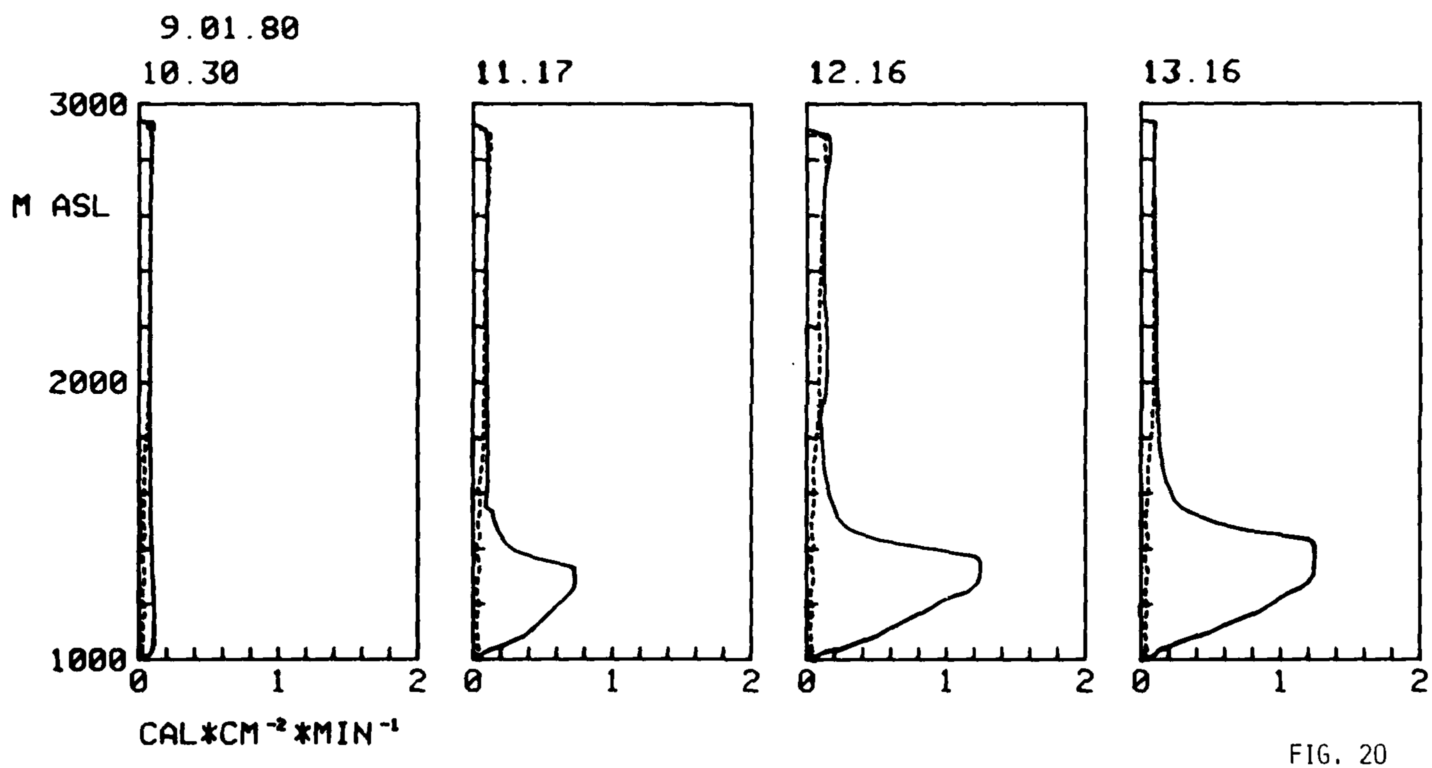

9.01.80
10.30
11.17
12.16
13.16
3000
M ASL
2000
1000
0
1
2
CAL*CM-2*MIN-1

FIG. 20

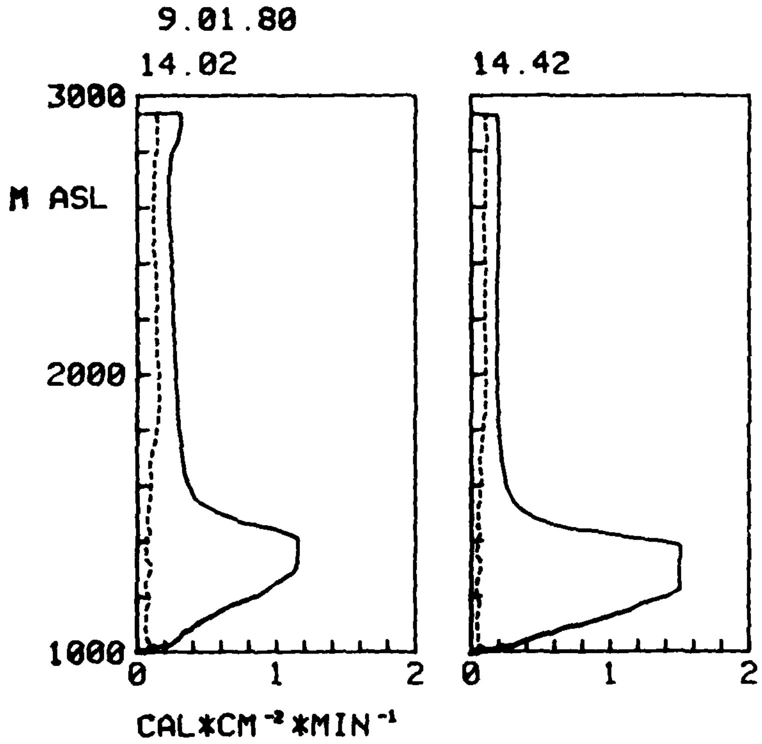


FIG: 21

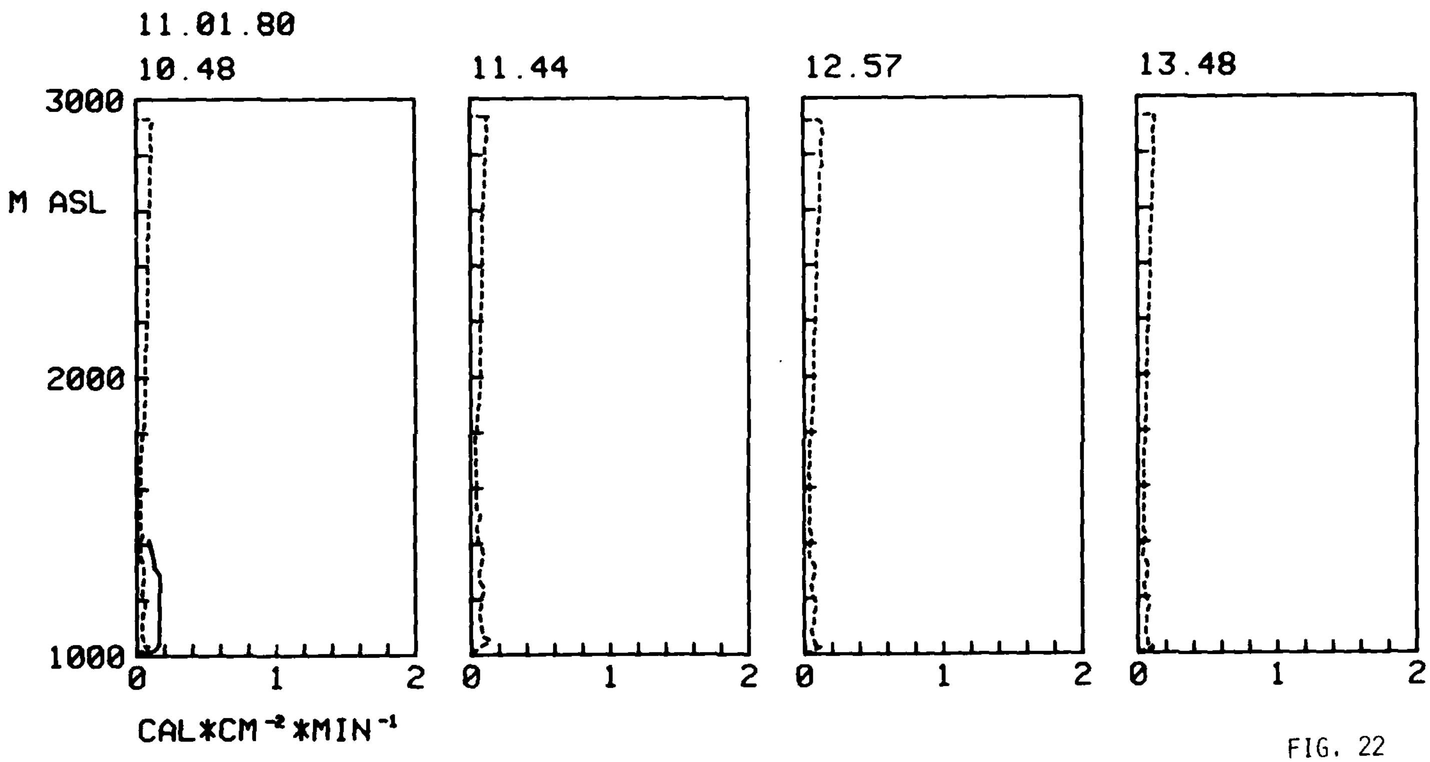

11.01.80
10.48
11.44
12.57
13.48
3000
M ASL
2000
1000
0
1
2
CAL*CM⁻²*MIN⁻¹

FIG. 22

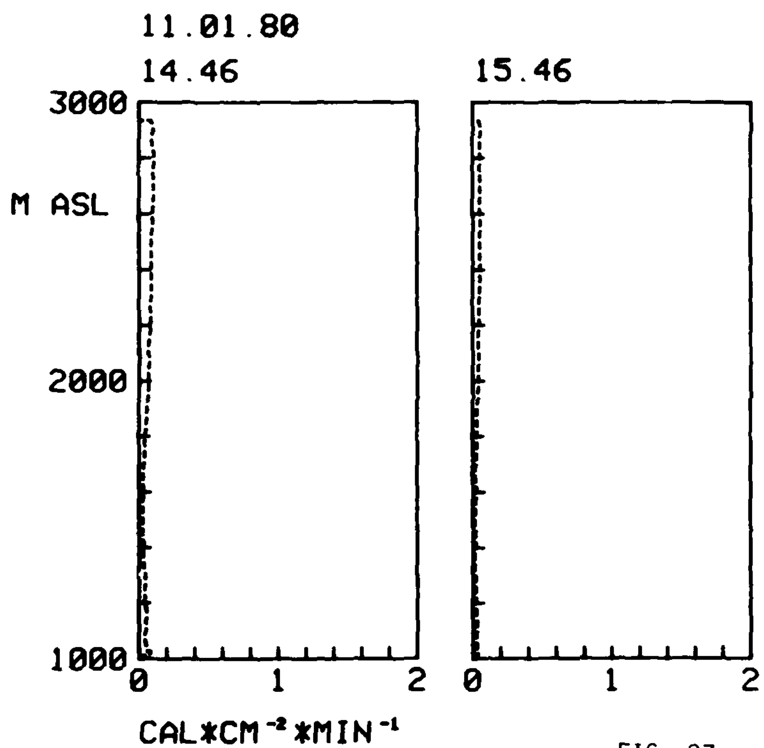


FIG. 23

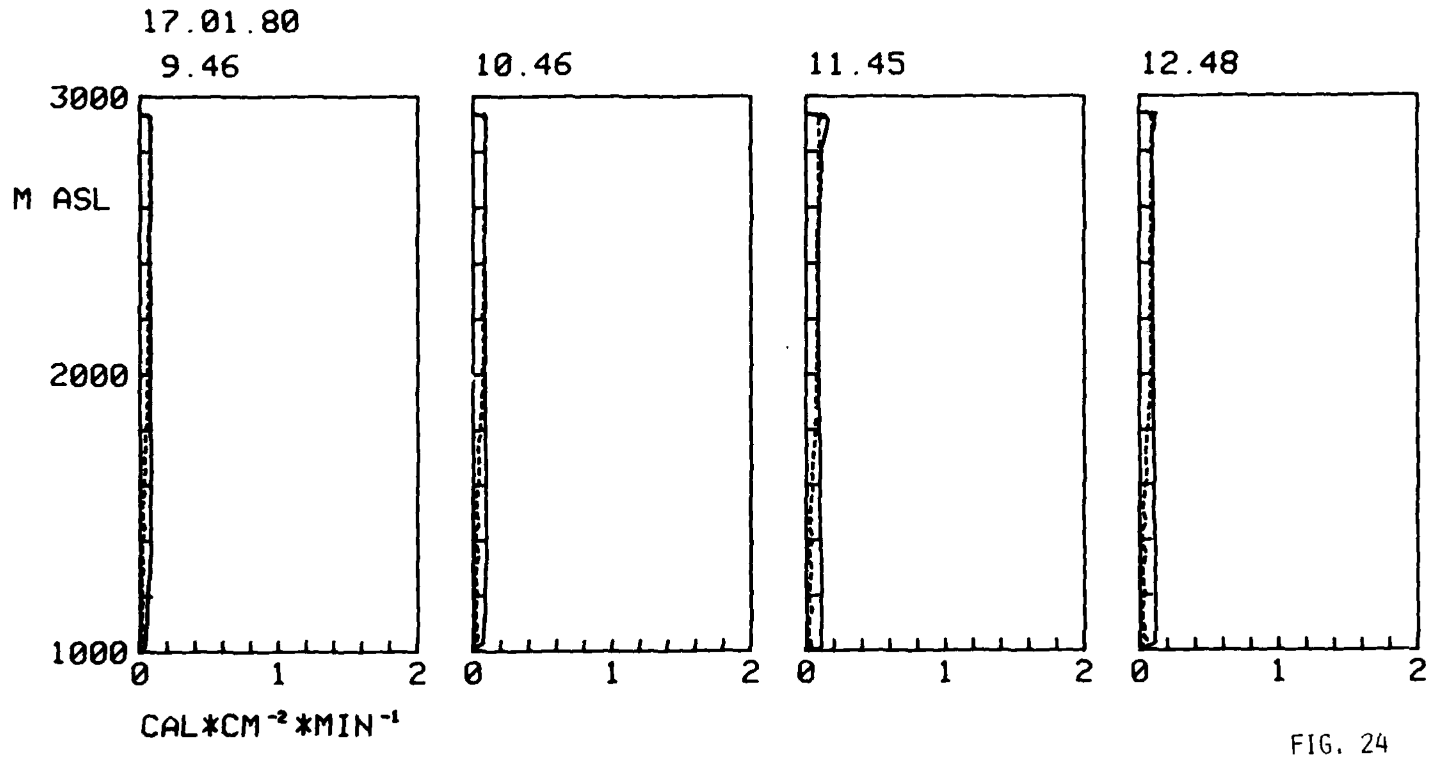

17.01.80
9.46
10.46
11.45
12.48
3000
M ASL
2000
1000
0
1
2
CAL*CM-2*MIN-1

FIG. 24

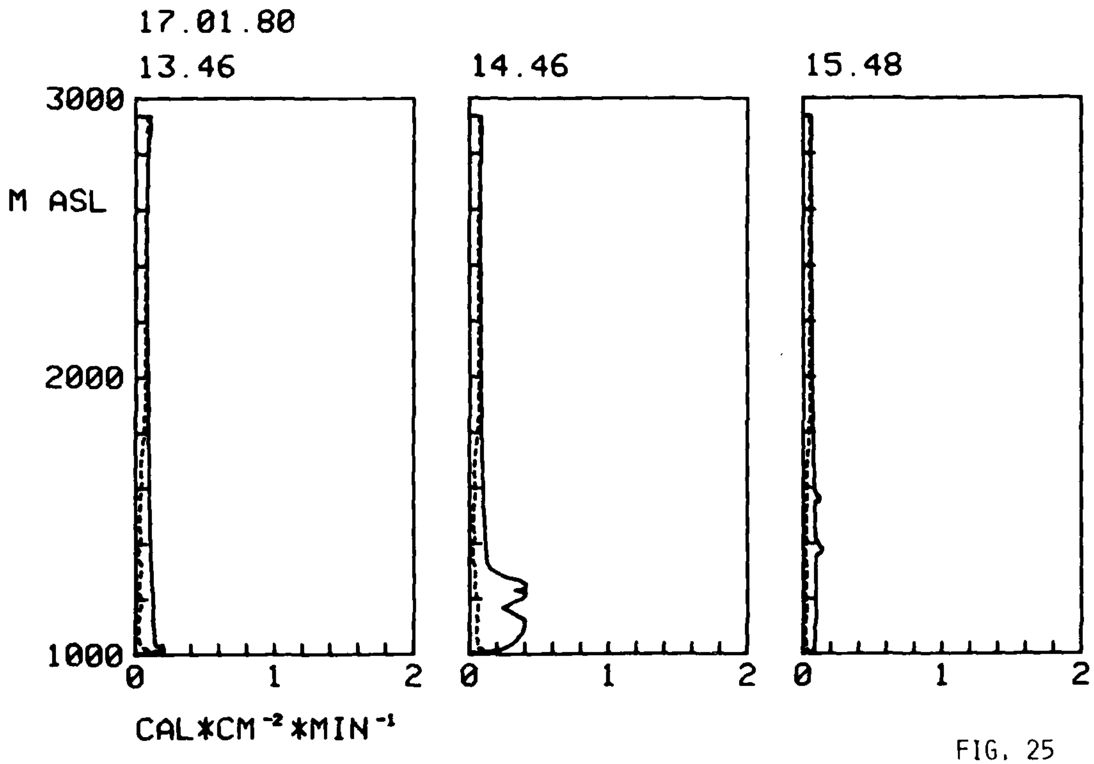


FIG. 25

F I G U R E S 26 - 48

Results for period June 1979 - January 1980

for previous results see

SECOND ANNUAL REPORT

Height profiles of the calculated albedo

On top of each individual diagram date and time

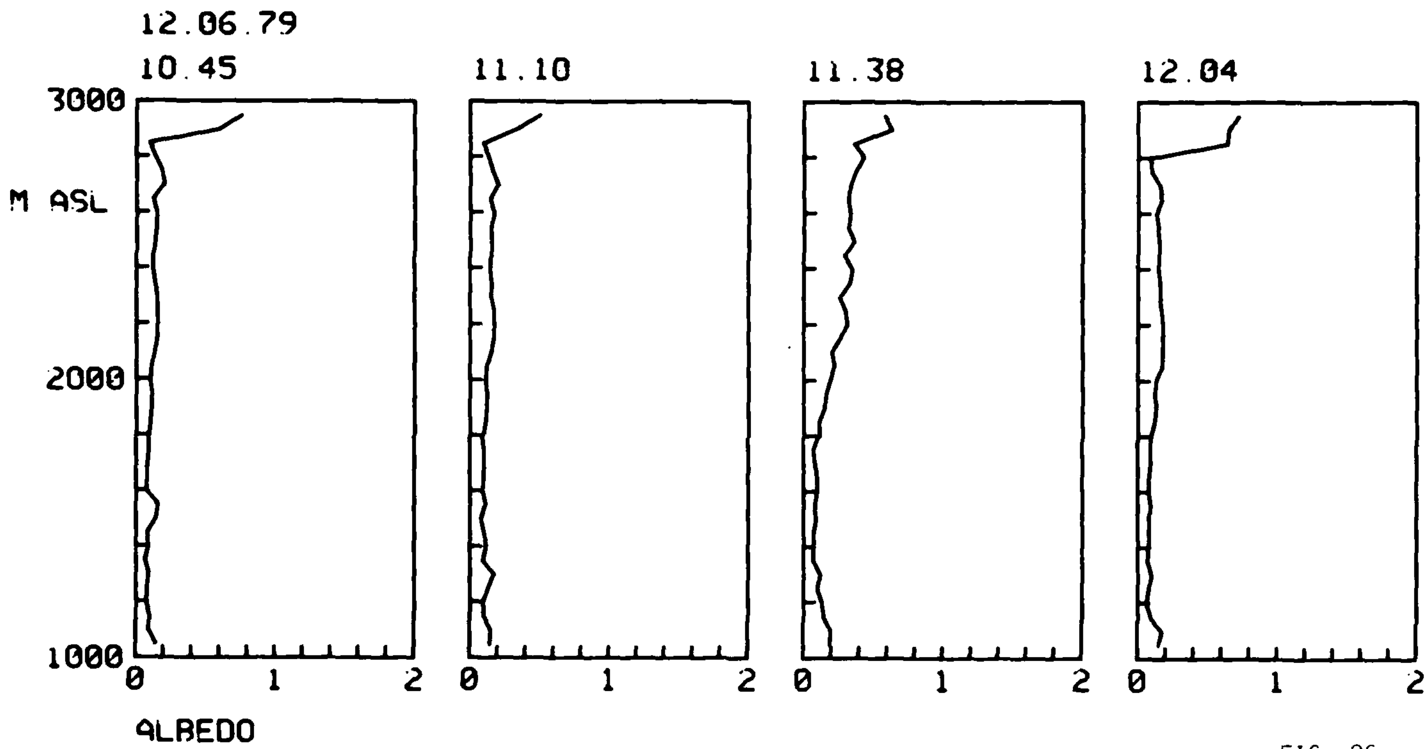


FIG. 26

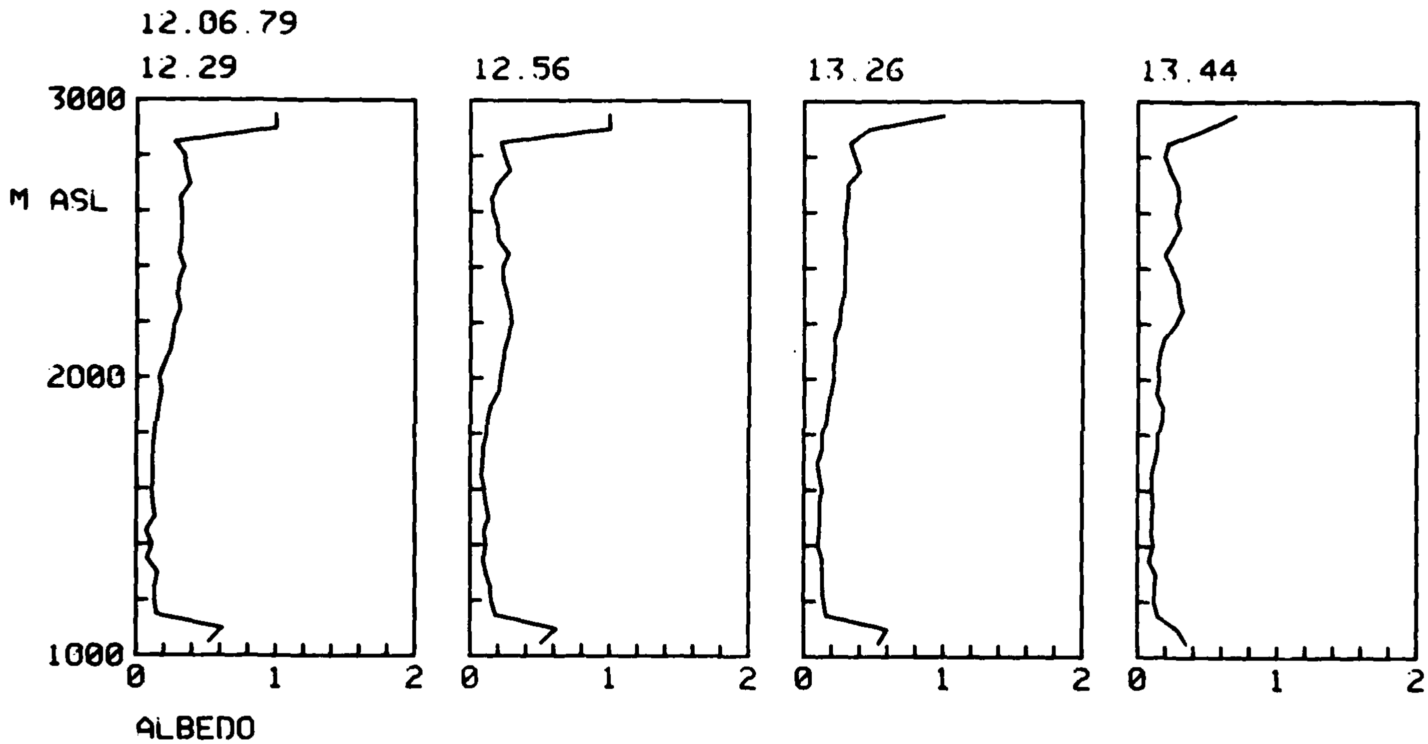


FIG. 27

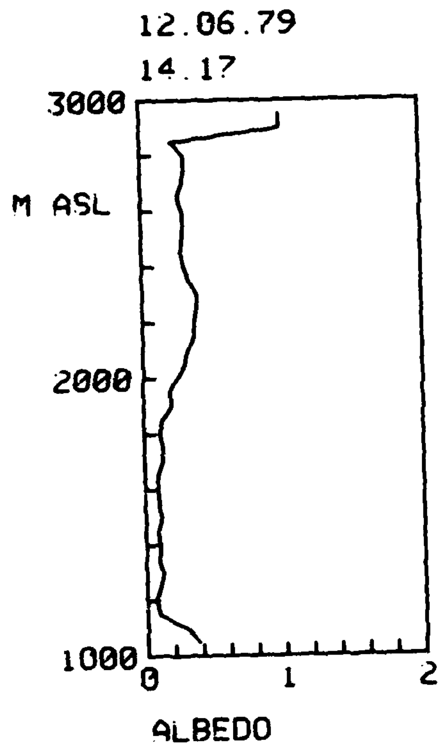


FIG. 28

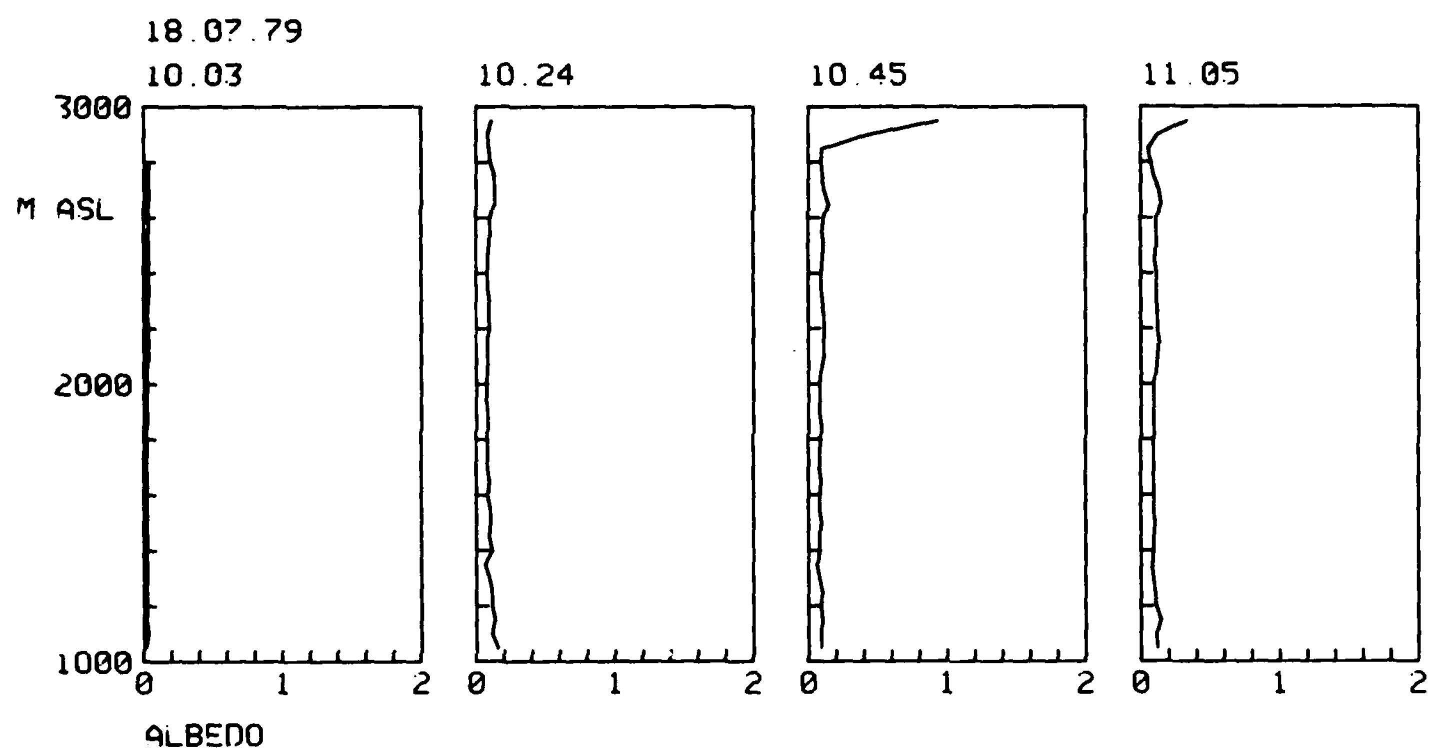


FIG. 29

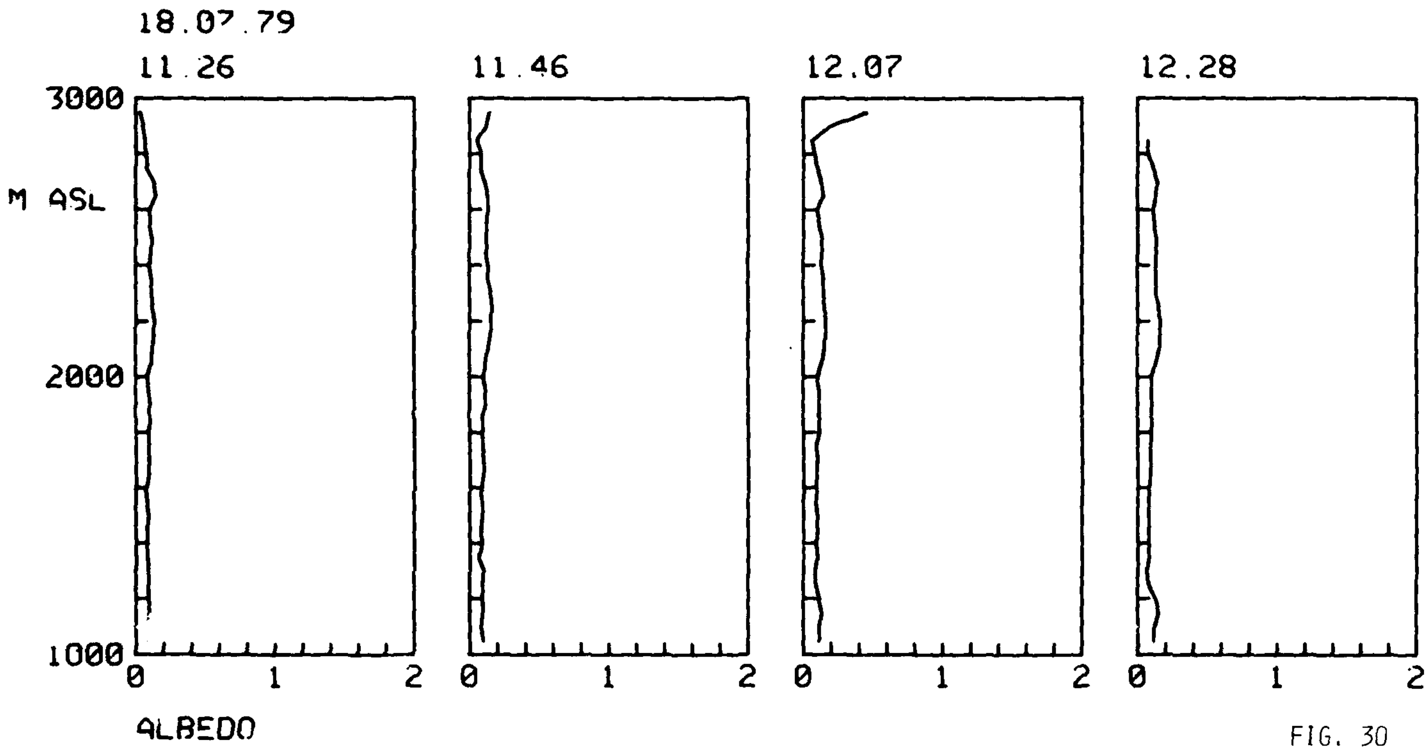


FIG. 30

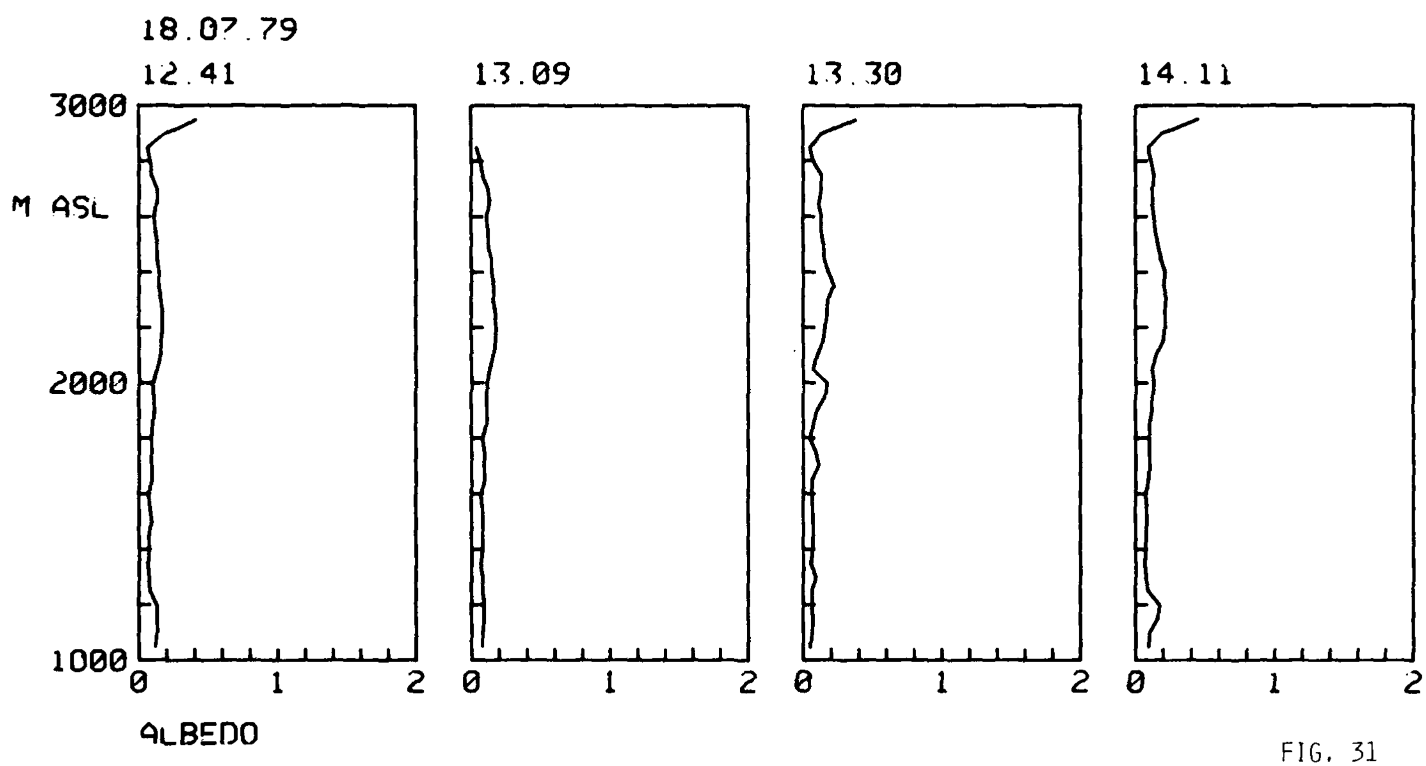


FIG. 31

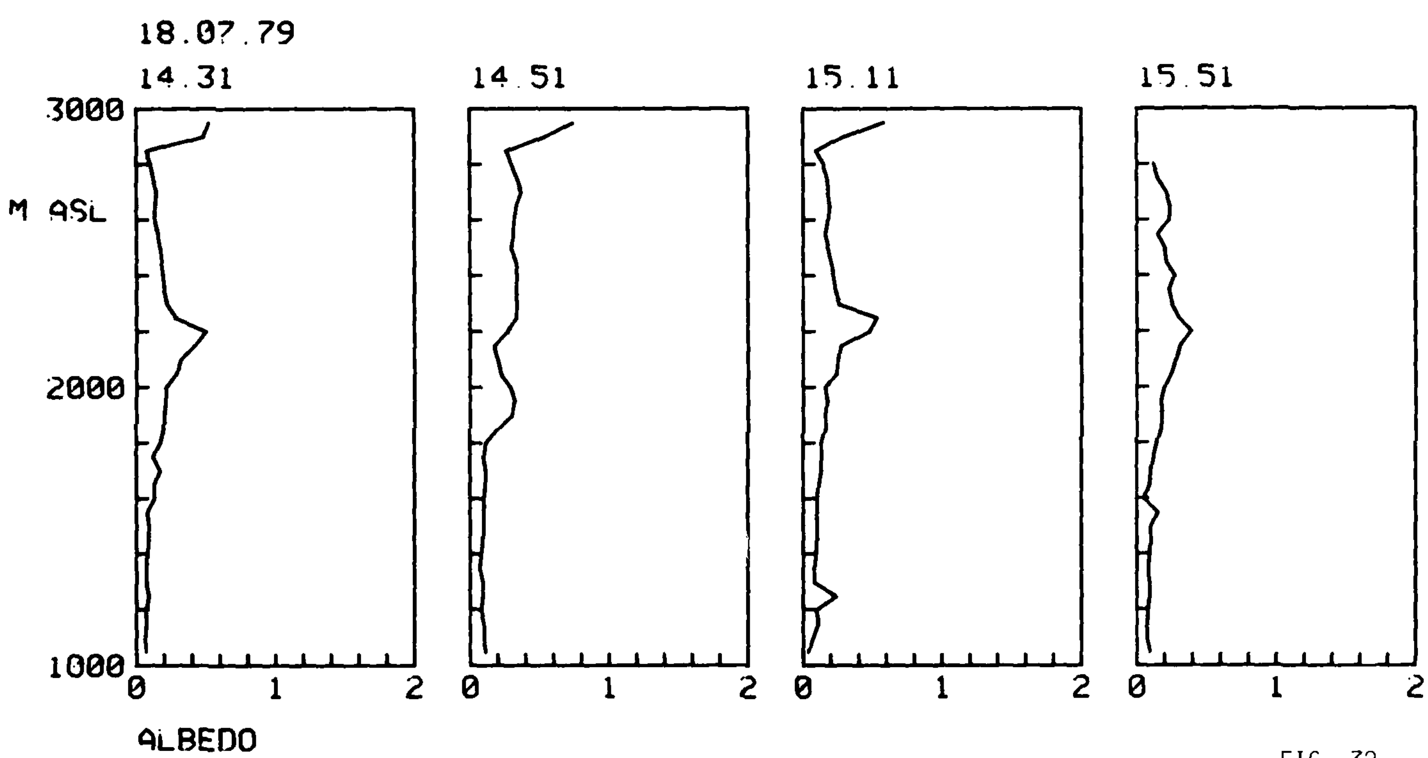


FIG. 32

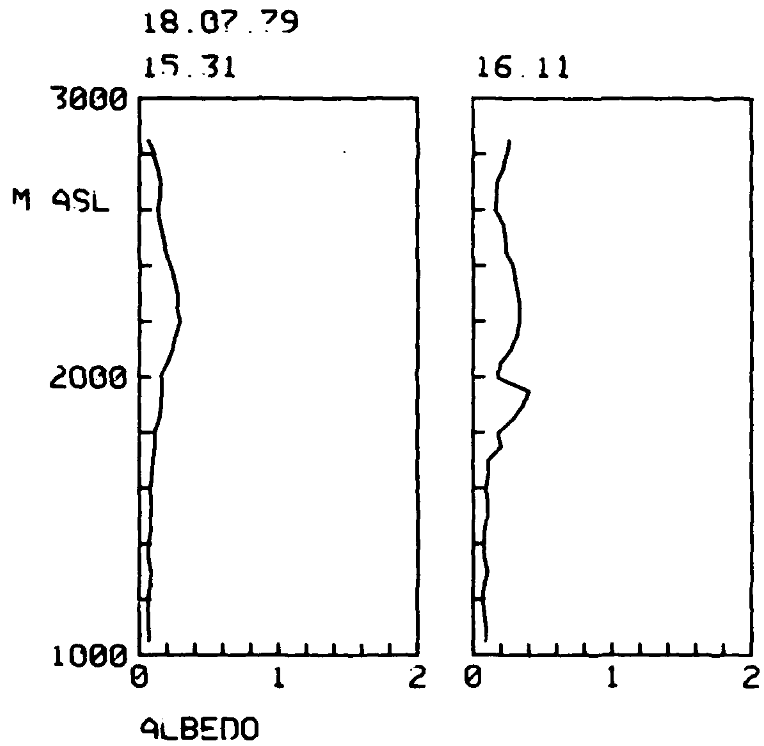


FIG. 33

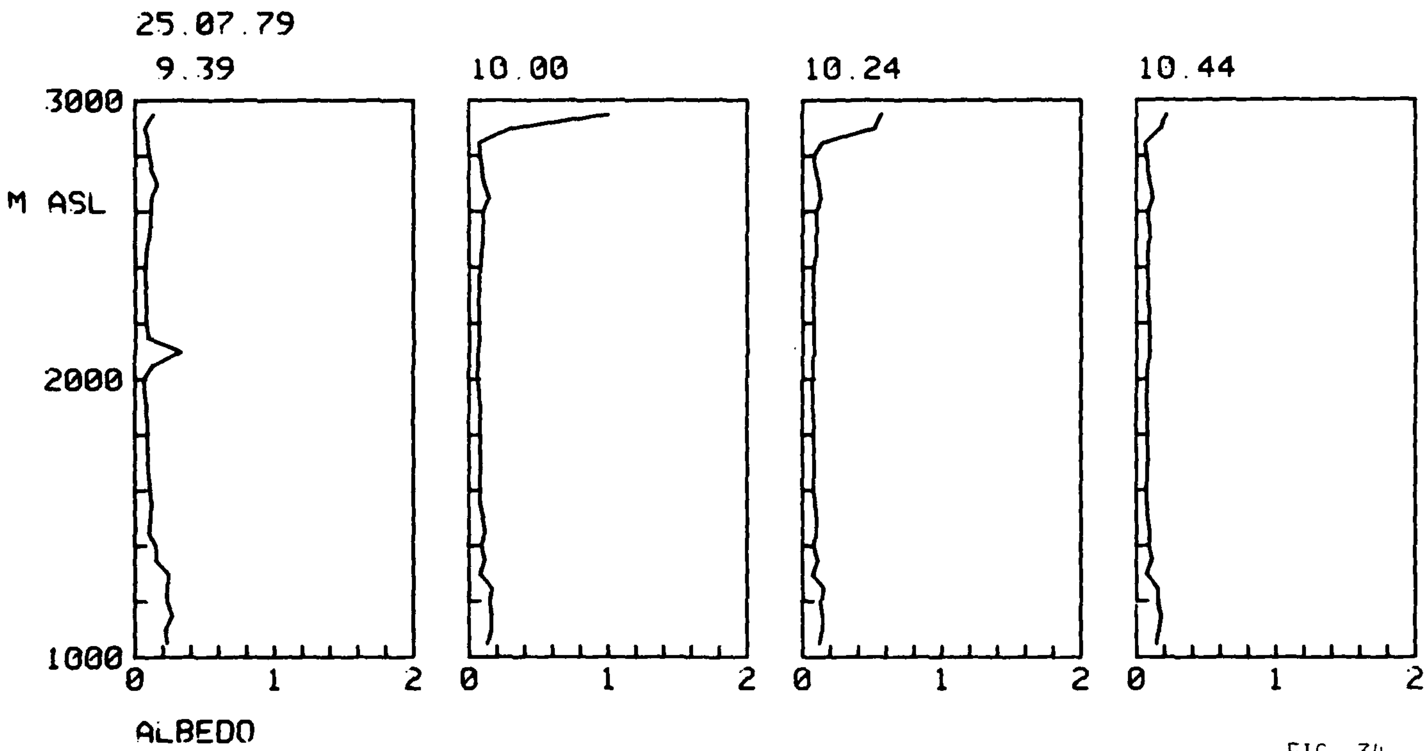


FIG. 34

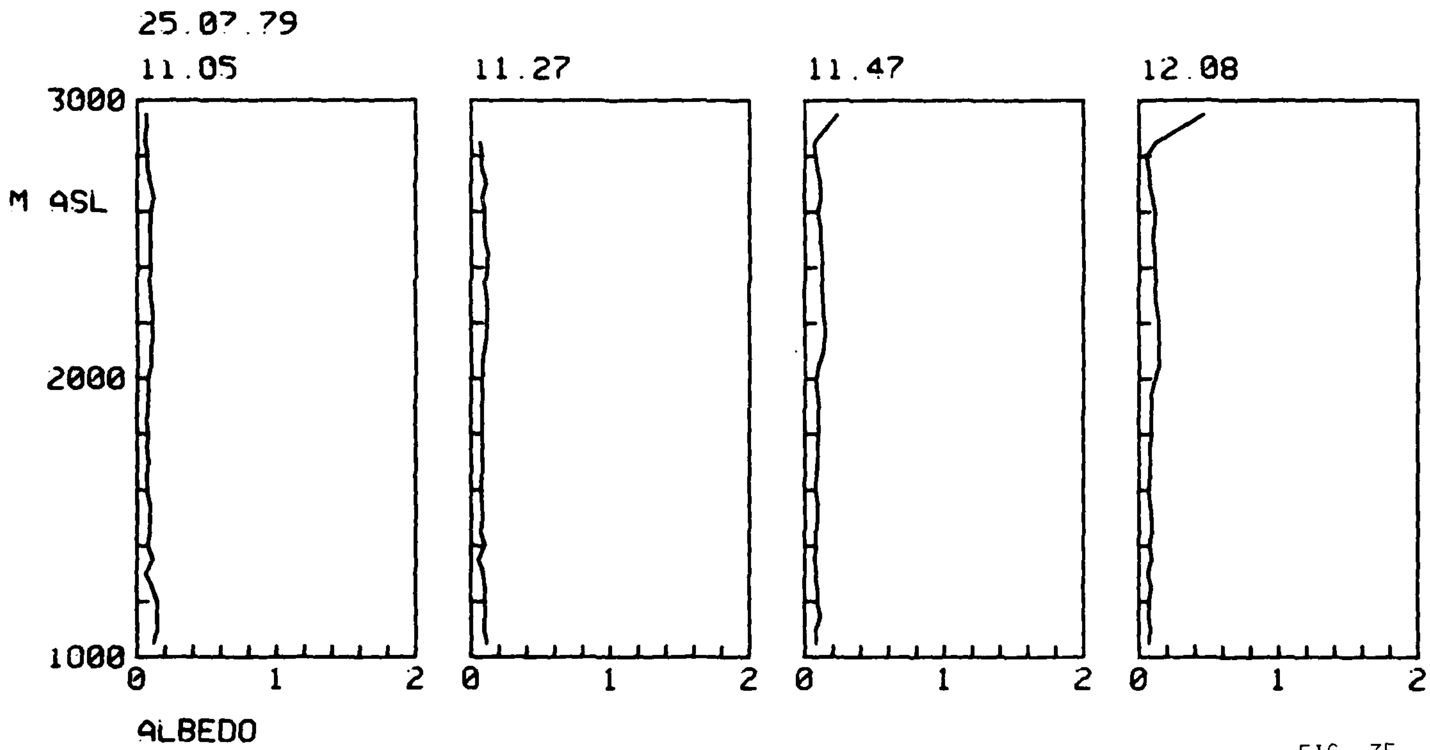


FIG. 35

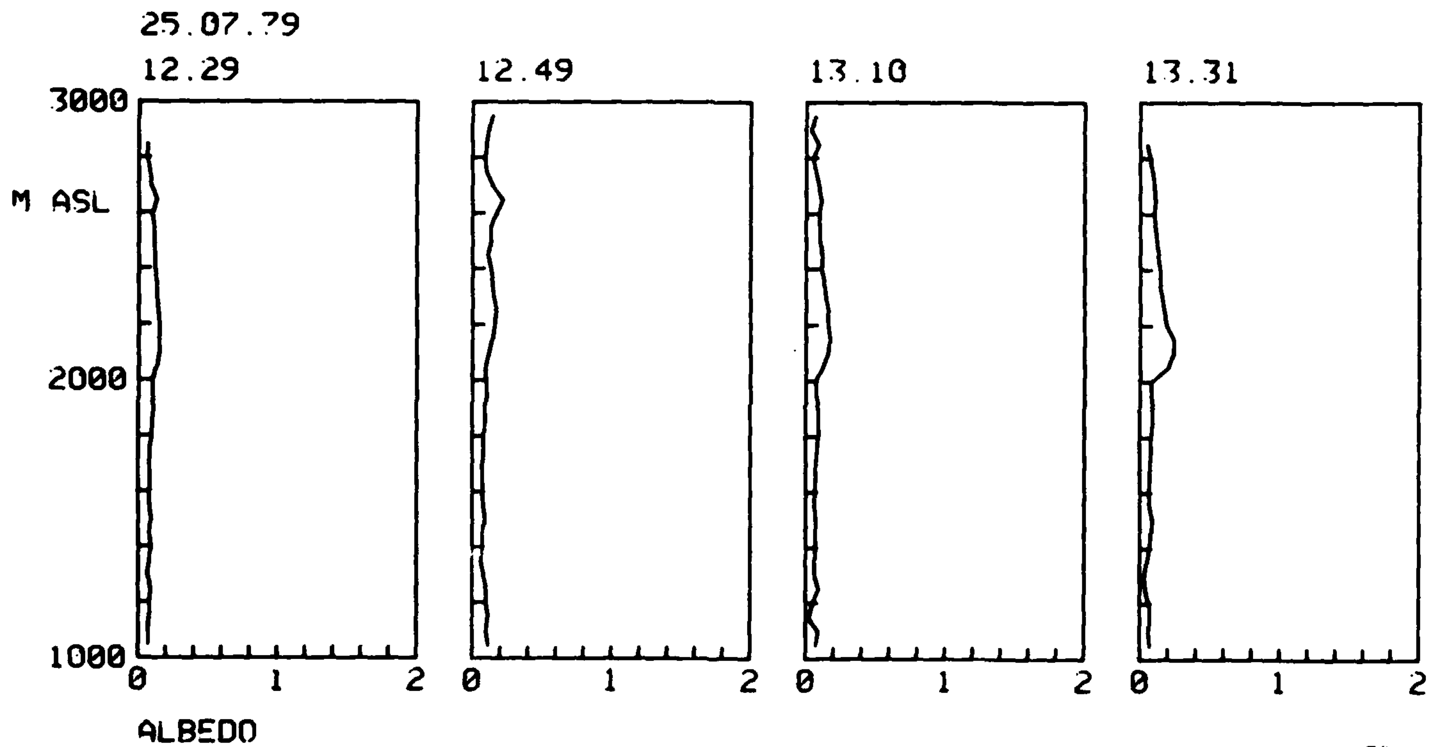


FIG. 36

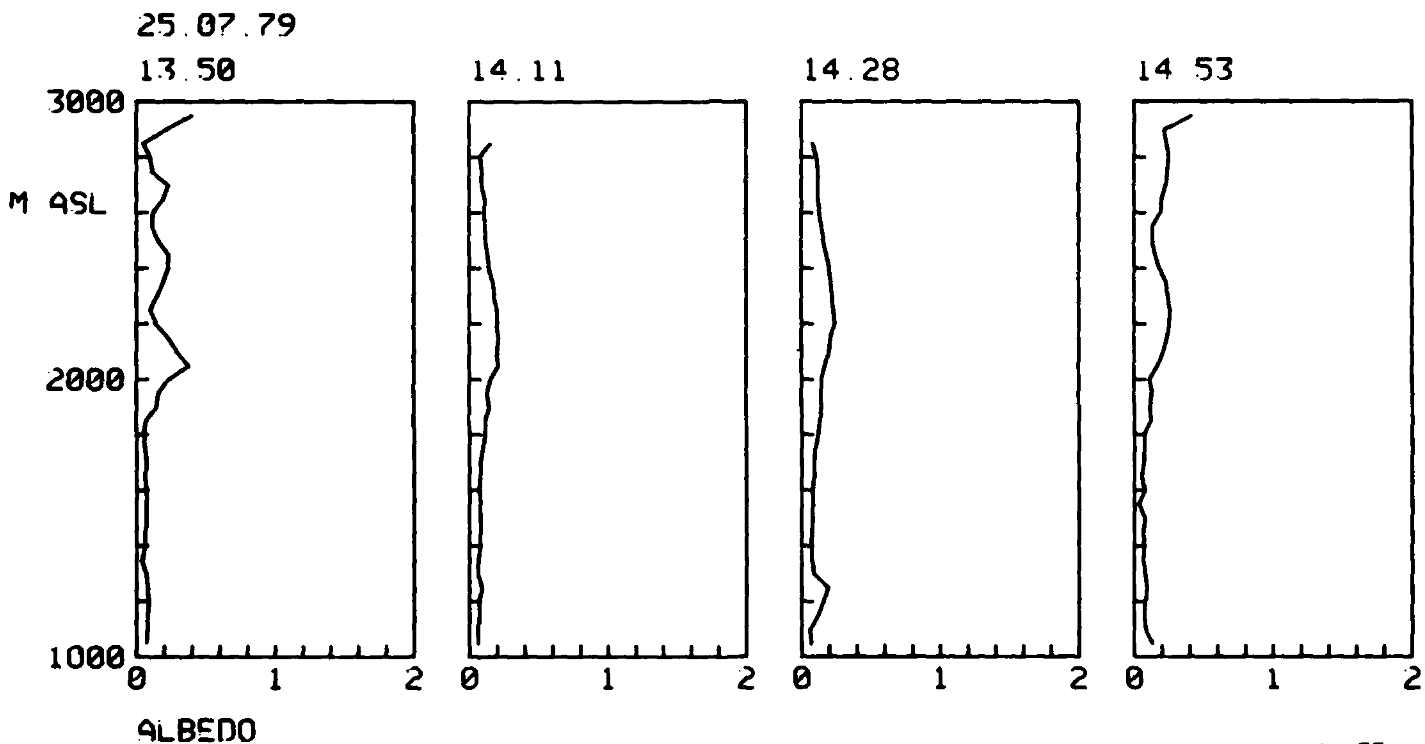


FIG. 37

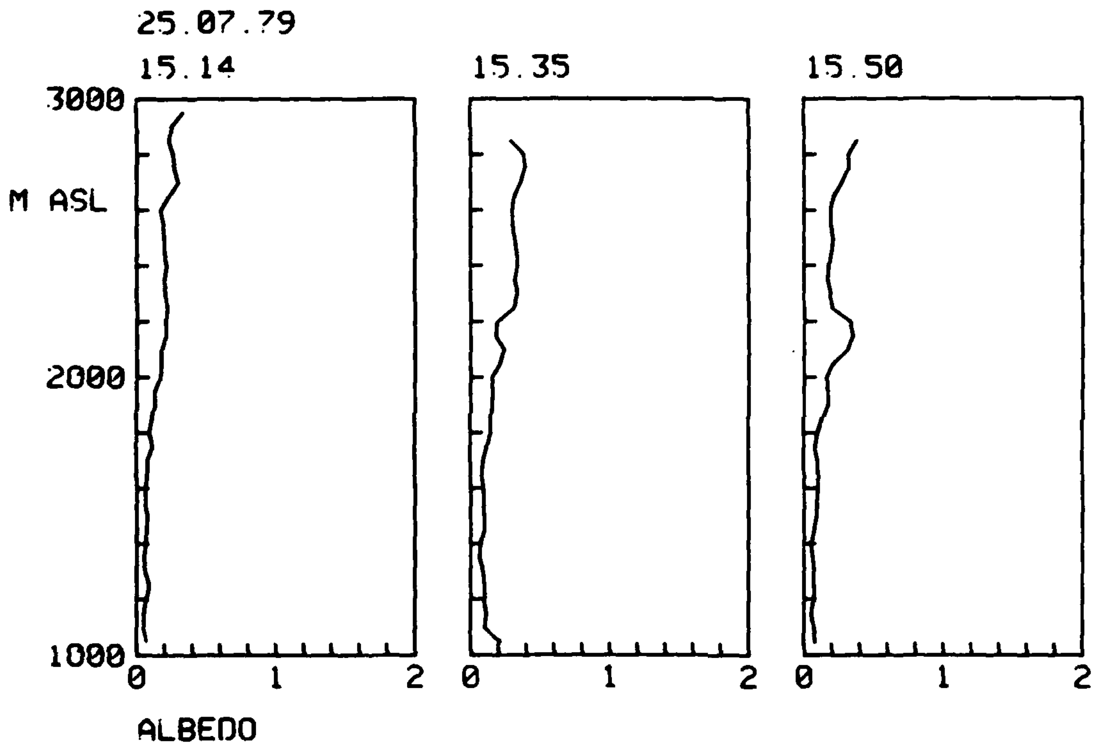


FIG. 38

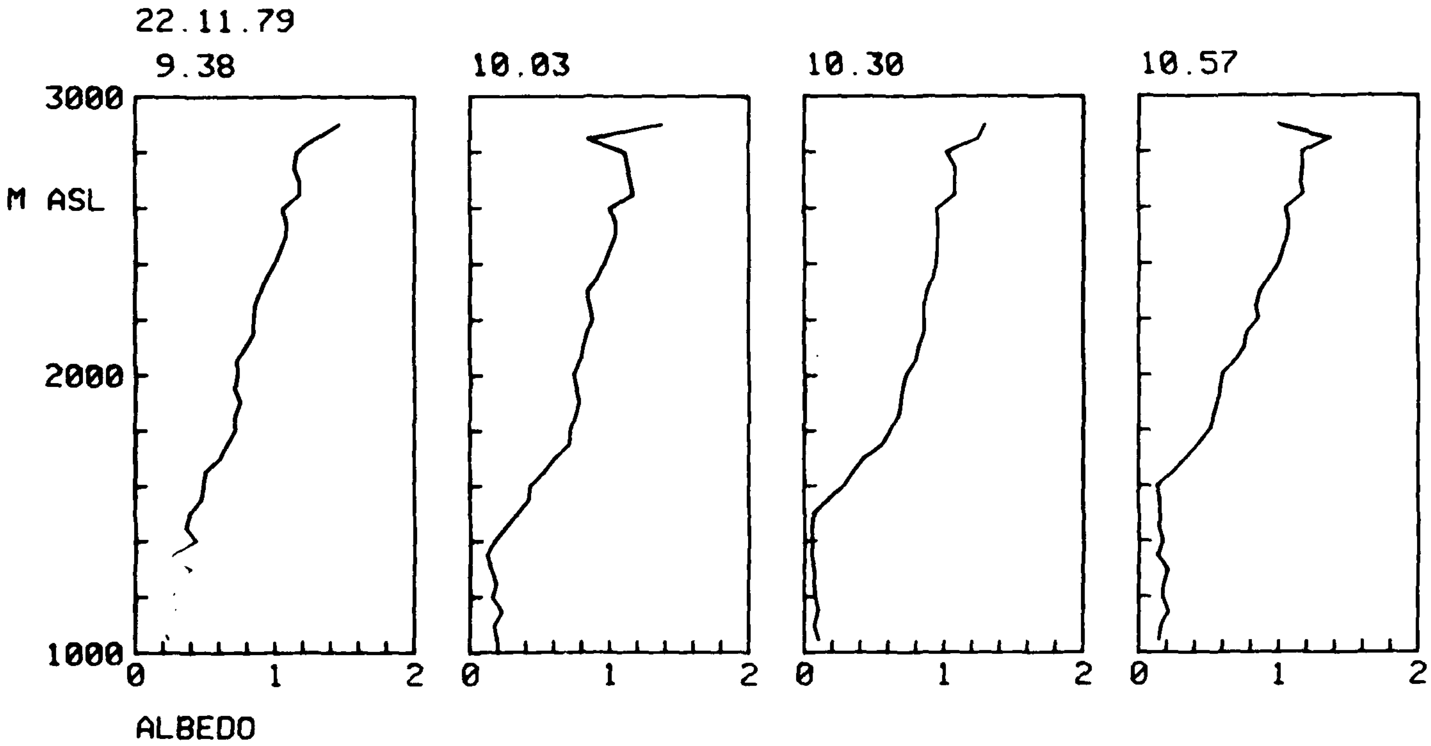


FIG. 39

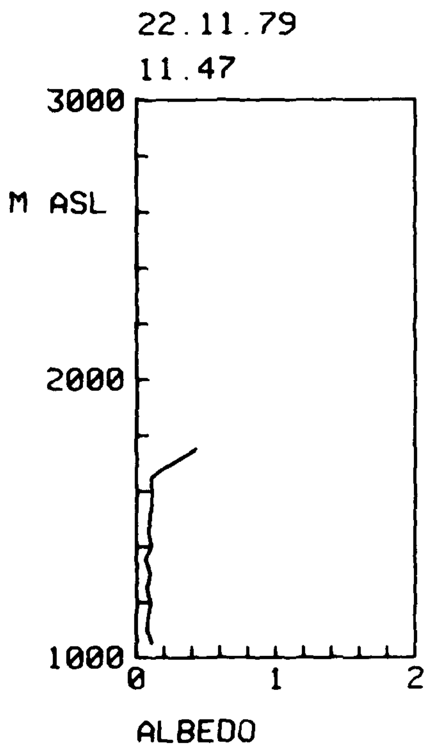


FIG. 40

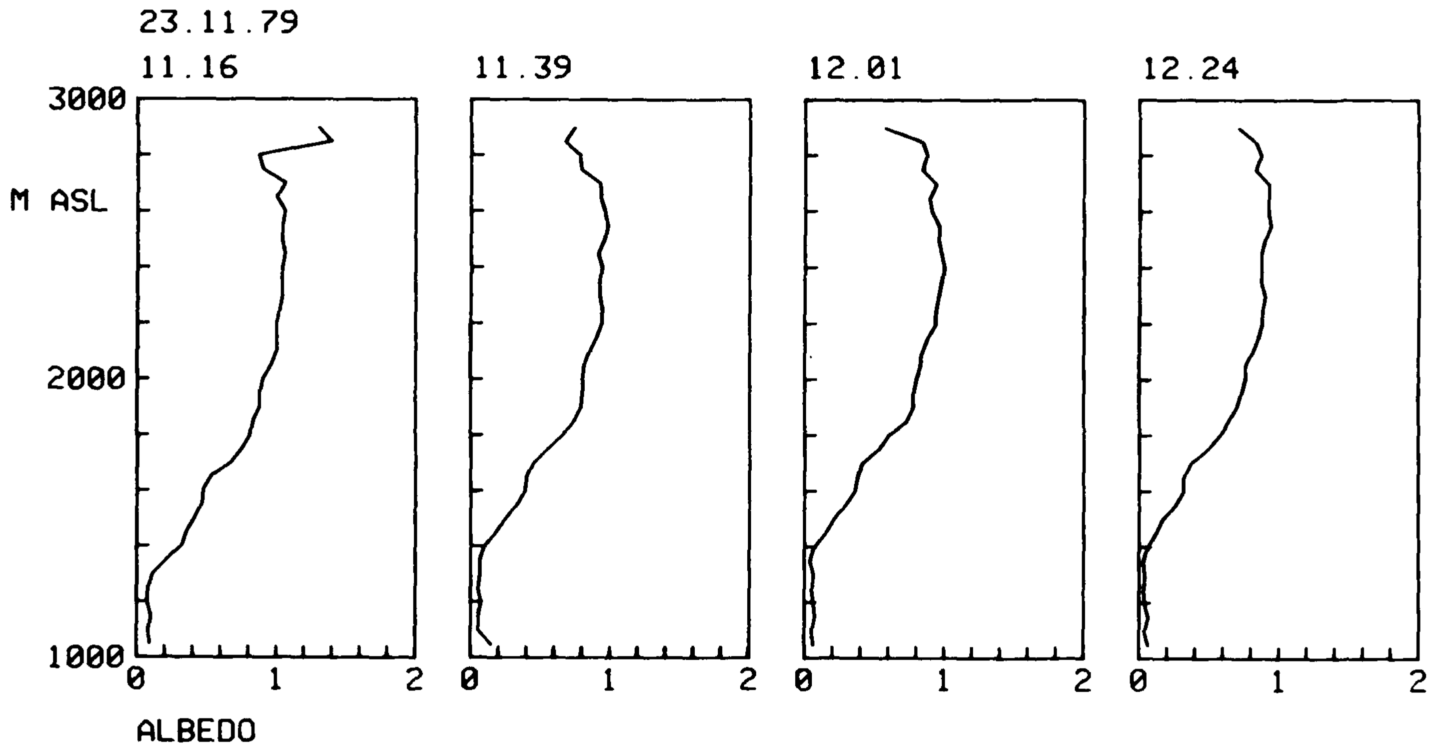


FIG. 41

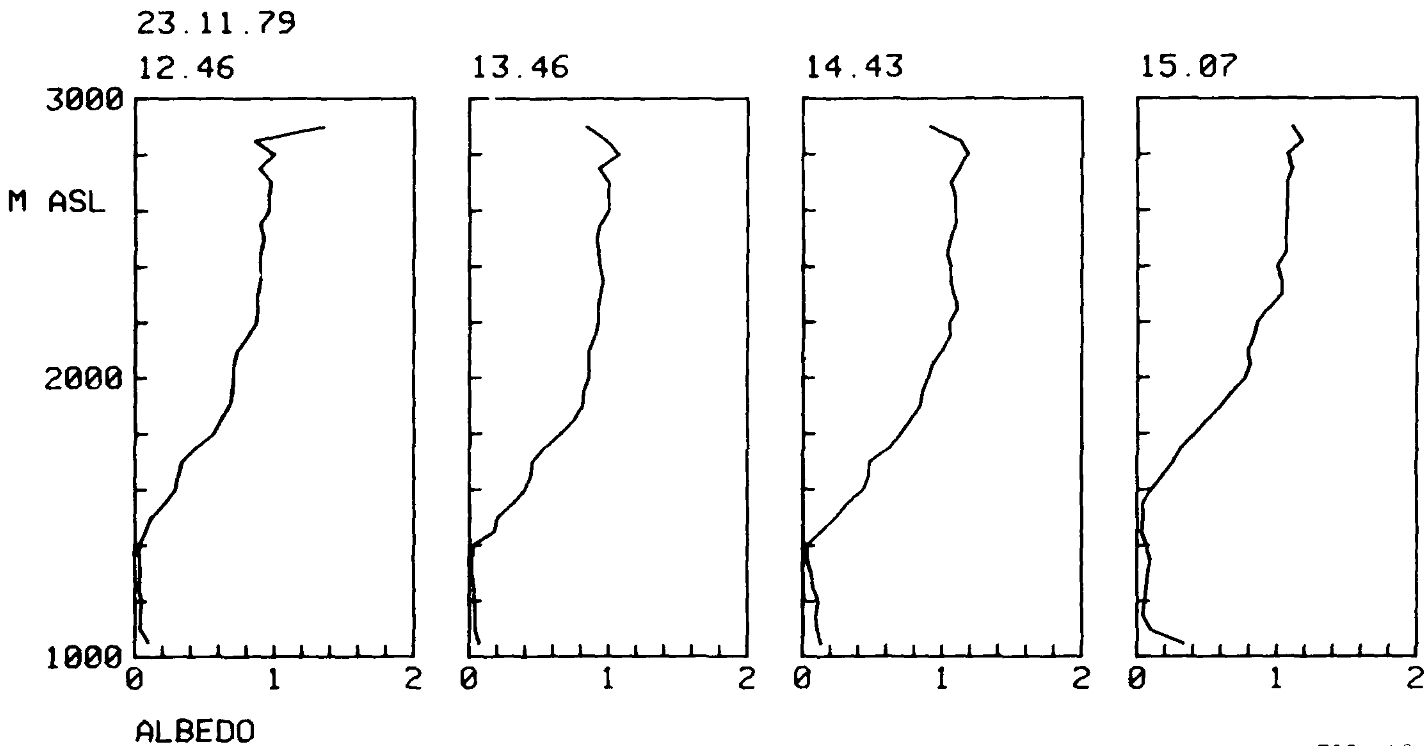


FIG. 42

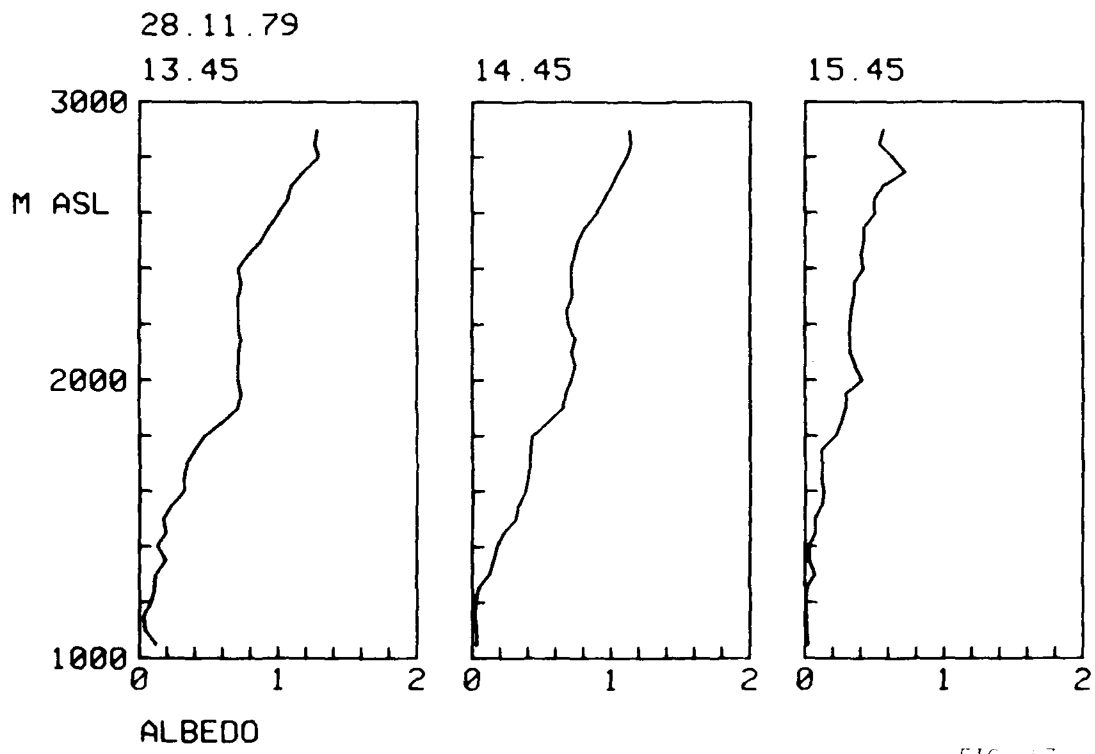


FIG. 45

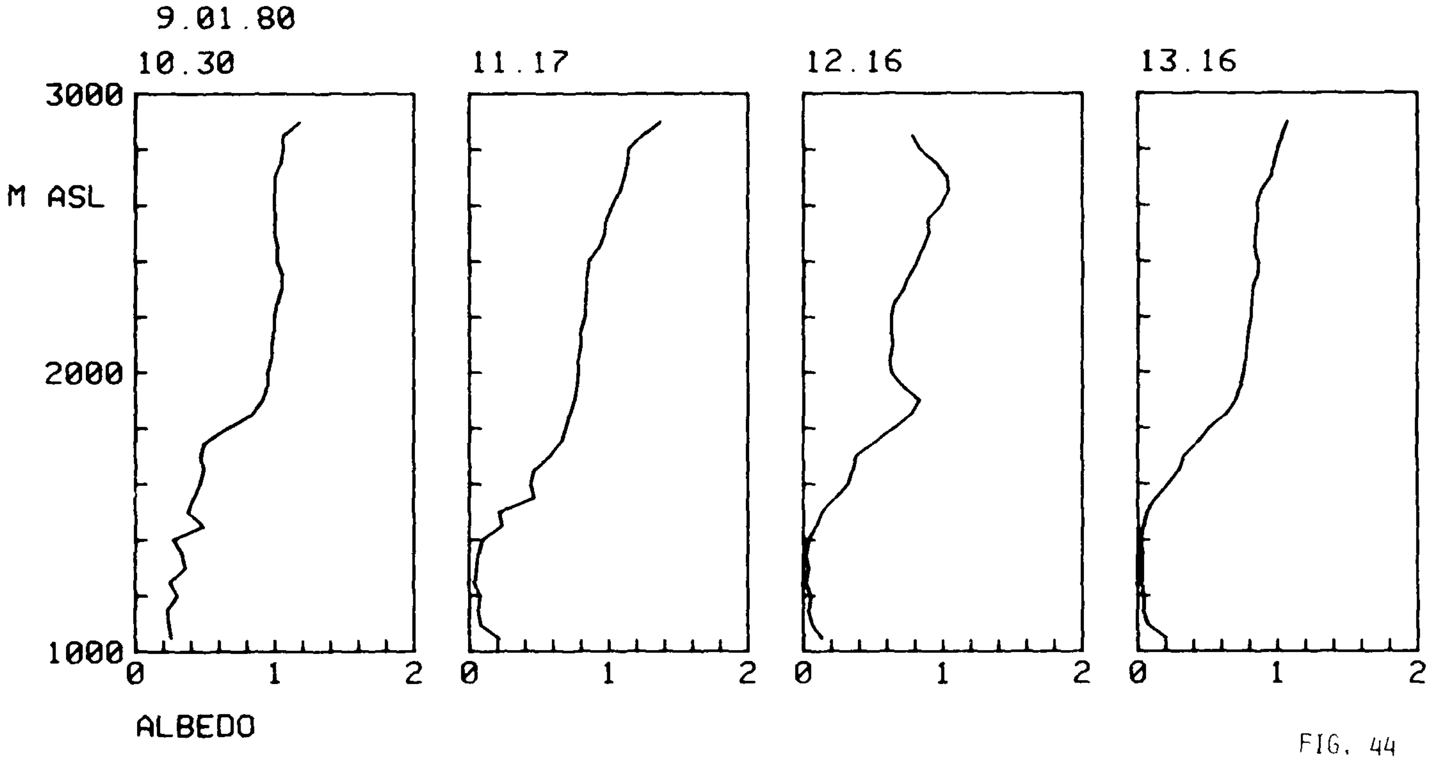


FIG. 44

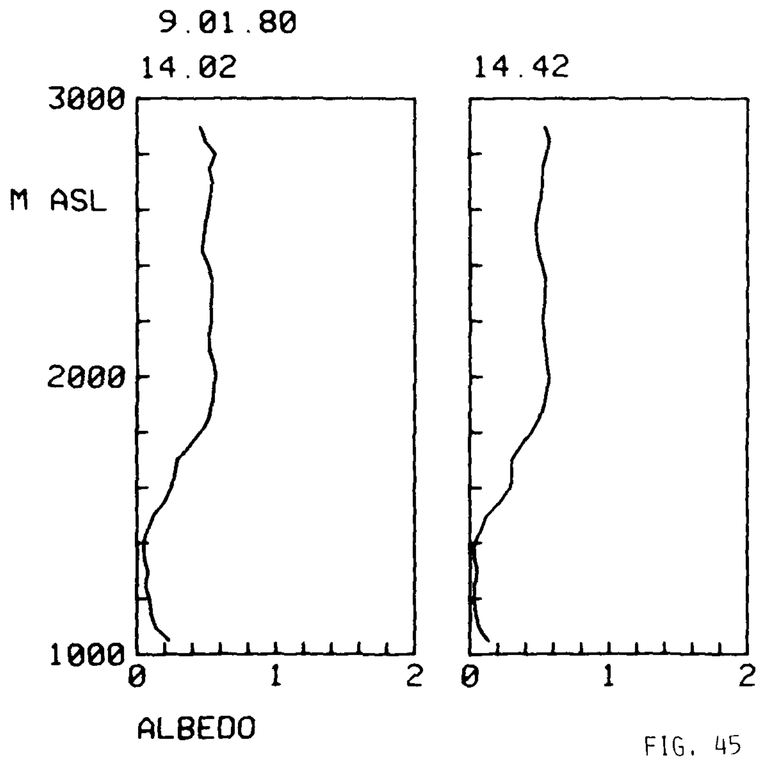


FIG. 45

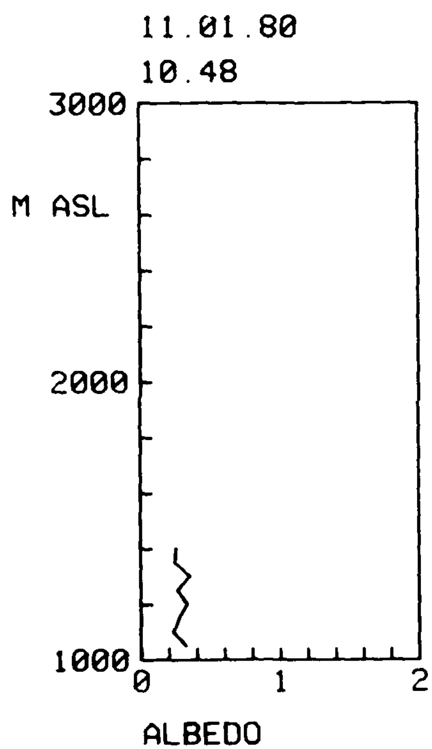


FIG. 46

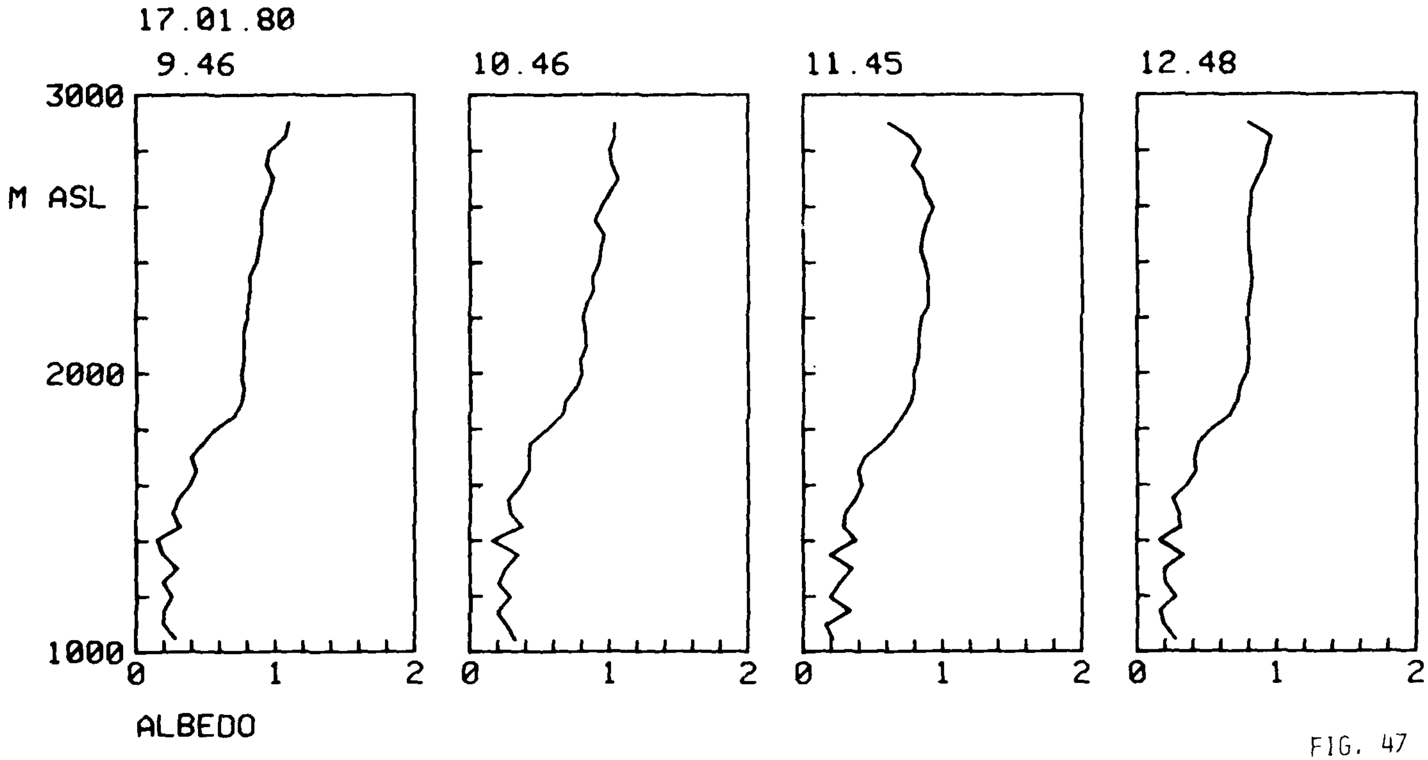


FIG. 47

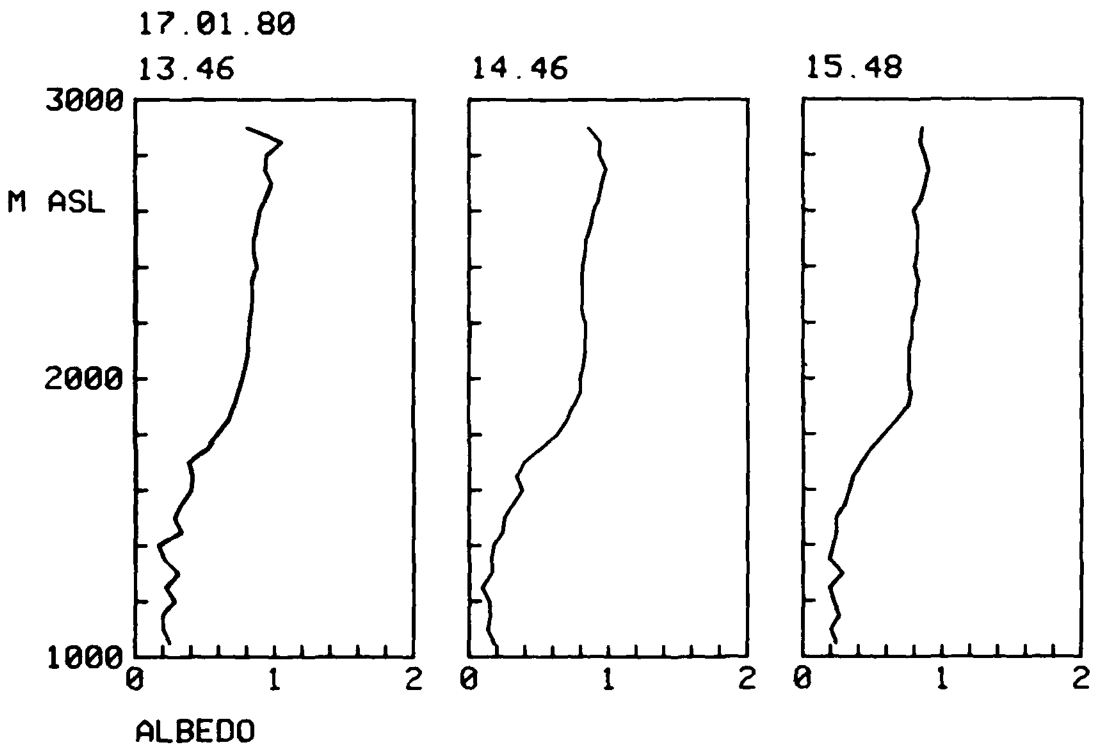


FIG. 48

EN

DAT

FILM

7 -

DT